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Erosion. I

America's Distressed Areas

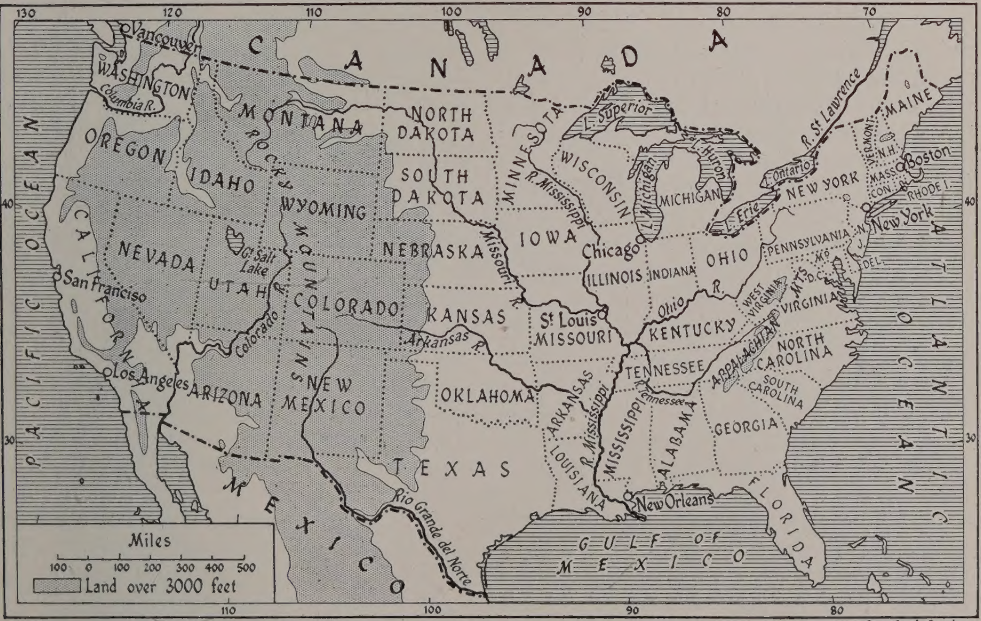
by ELSPETH HUXLEY

President Hoover once asserted that 'America's problems are those of growth, not of decay'. The falsity of the implied distinction between America and 'older' countries has been shown by Time and Nature (witness the ravages of soil erosion): humanity can as little escape their revenges on that side of the Atlantic as on this. In her present article, Mrs Huxley deals with the causes of erosion and its formidable results in the United States; a later article will survey the agricultural and social problems raised elsewhere by man's ill-treatment of the soil

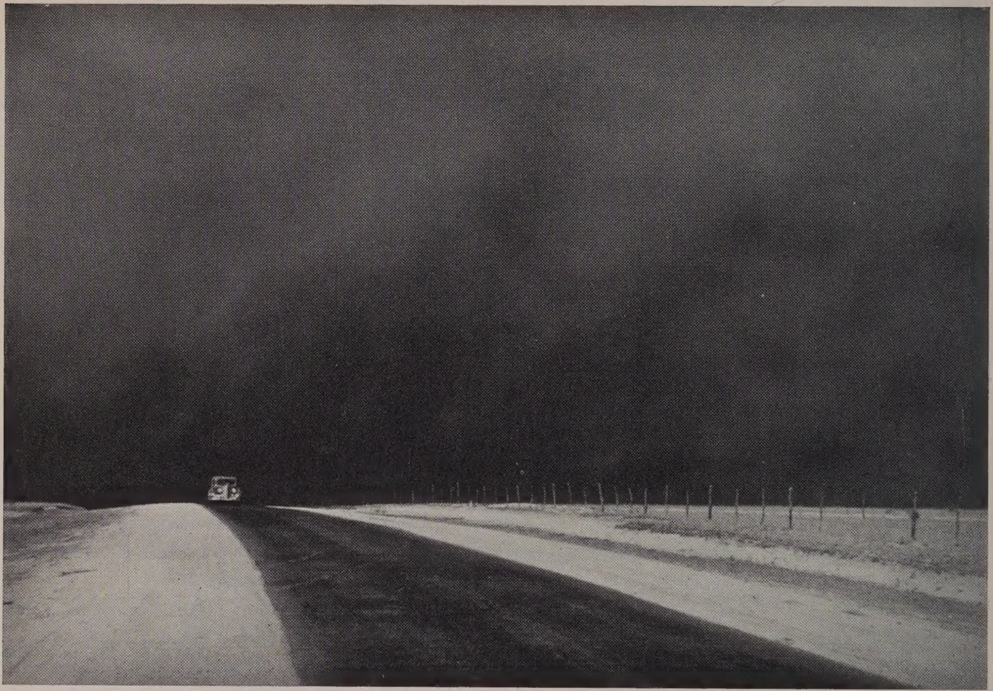
THREE years ago a man was driving along what had once been a farm road in Nebraska. It was spring, but the level landscape had no green cloak of young wheat or corn for cover. It stretched, brown and bare, to a lifeless horizon, and the traveller's eye could see only the authentic contours of a desert.

As he drove on through the soft sand he saw the remnants of a solitary tree. It was leafless, for its roots had withered, but it still stood. Prompted, perhaps, by respect for such obdurate endurance, he stopped the car and plodded through the sand to look at it. A bird flew out as he approached, and on inspection he observed a bird's nest in the fork of two blackened branches. It was a strange nest, for it shone like a pool of water in the sunlight. Then he saw that it was made out of bits of wire. In all that desolate land the bird had found no twigs, no leaves, no feathers, no moss, with which to express its nesting instinct: only bits of broken fence-wire from some deserted farmstead.

Sixty years ago this stretch of land, the Nebraska panhandle, was a green sea of tall grass, chequered with dark patches of woodland, the home of wild birds and beasts. Its story can be read in a book



Stanford, London.



U.S. Resettlement Administration

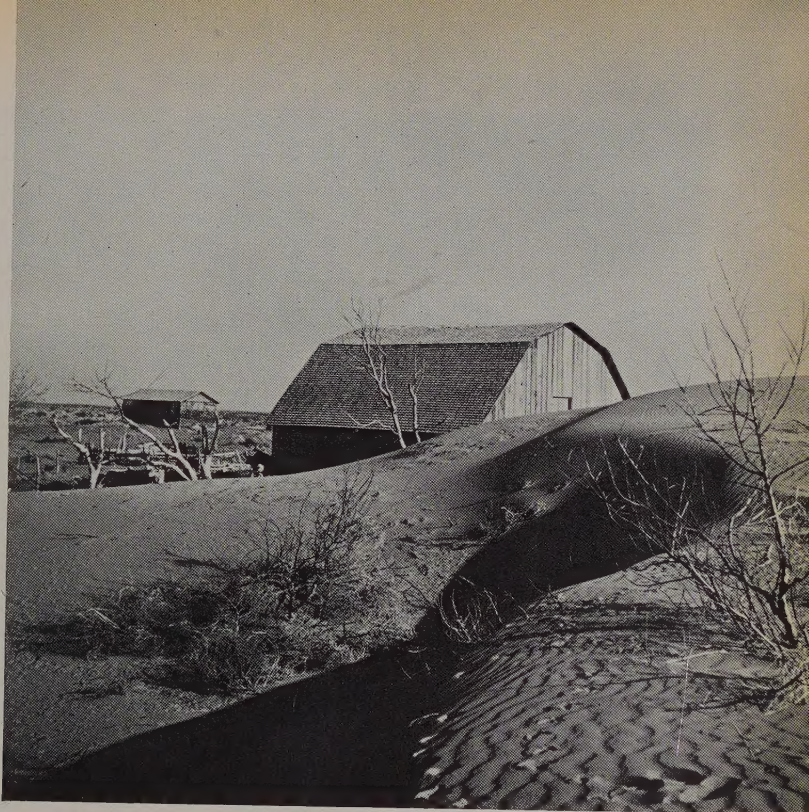
Man with his plough lays bare the earth's surface and weakens its cohesion; there is a dry spell; the wind arises and bears the soil away. A dust storm in Texas

published about a year ago, the biography of the first settler to enter it, a Swiss student who became known as Old Jules. When Old Jules was young he slew bison in hundreds for their hides and kept his family lavishly in meat by the slaughter of the wildfowl, 'possums, squirrels and other animals that then abounded. In the span of one man's lifetime that wealth of wild life has been wiped off the face of the earth as completely as a picture scratched in sand is obliterated by the incoming tide, and the fertile grassy plains across which the first settlers so hopefully drove their wagons have been turned into a waste of desert offering no sustenance to man or beast.

Old Jules was a farmer, and the greater part of his life was spent in a bitter fight with the cattlemen, who claimed for their beasts what farmers wanted for their ploughs. The fight was long and savage. Farmers put up fences and cattlemen tore them down; and both sides argued with the rifle. The farmers won. Fences advanced over the plains in the straight disciplined columns of the invader; ploughs set upon the range like caterpillars upon cabbage leaves; and the cattle were driven westwards in protesting herds. But in the end the farmers, too, were beaten and driven forth, as they had driven the cattlemen. Now the land has become a semi-desert, ploughs are idle, and fences buried. Had victory gone to the cattlemen in Old Jules' youth, America's history would have been different and her depleted wealth, perhaps, intact.

This story of a part of the Nebraska panhandle is one incident in a tragedy that is being enacted in many other parts of the United States and in many other countries.

All that remains of a farm in Nebraska after wind erosion has done its work: deserted buildings and dead trees half buried in dust. The owner and his family, ruined and homeless, can only seek charitable relief, unless they are lucky enough to be reestablished on a new farm by the Resettlement Administration. (Below) *Removing drifts of soil which block the highways near Guymon, Oklahoma*



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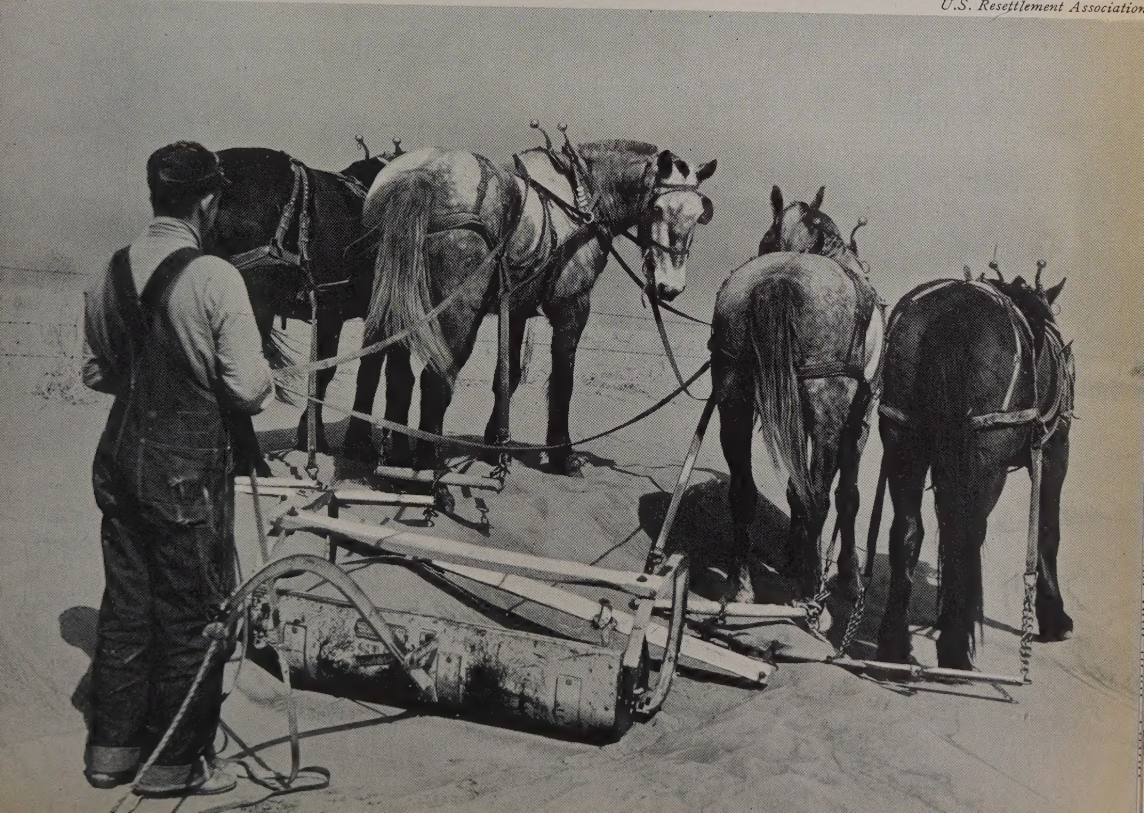
U.S. Resettlement Associatio



U.S. Resettlement Association

An abandoned farm in Idaho, on 'sub-marginal' land never really suitable for cultivation and now exhausted, which has been bought by the Resettlement Administration and is to be returned to pasture

It is the tragedy of the death of soil fertility—not a natural death, but one resulting from the improvident treatment of the land at the hands of men.

Nature, over millions of years, has established a delicate and subtle balance between soil and vegetation on the one hand, and human and animal life on the other. Man, in a few years, has so upset this balance that human and animal life is rapidly destroying the soil and vegetation which make and sustain the two higher forms of life.

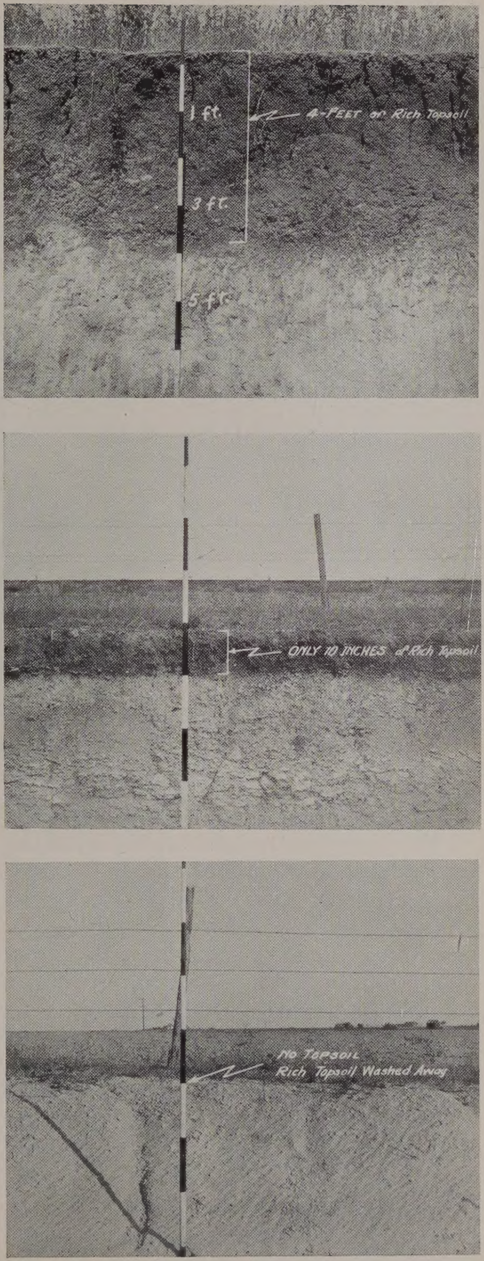
There can be only one outcome. 'When the soil goes,' Theodore Roosevelt said, 'man must go too', and take his animals with him. He cannot exist in a waterless desert. Vegetation goes first, the soil follows; man and animals are the last to retreat, but go they must, never (unless, perhaps, one thinks in terms of geological aeons) to return. For the process of soil destruction, like certain chemical reactions, can be irreversible: once it has passed a certain point, that is, soil fertility cannot be coaxed back to life, whatever man may do.

The method used by man to render land uninhabitable may be summarized in one phrase: the destruction of vegetative cover. A thin envelope of topsoil and subsoil surrounds the earth. It is a vitally important envelope, for if it were to be stripped away a core of rock would be exposed below, and the plants which provide man with food and clothing cannot grow on rock. It is a delicate envelope, easily washed away by heavy rain or blown away by strong winds if it is left unprotected. It is an inconstant envelope, continuously being pared on the surface by two erosive agents, wind and water, and renewed from beneath by the very gradual breaking down of rock into particles of soil.

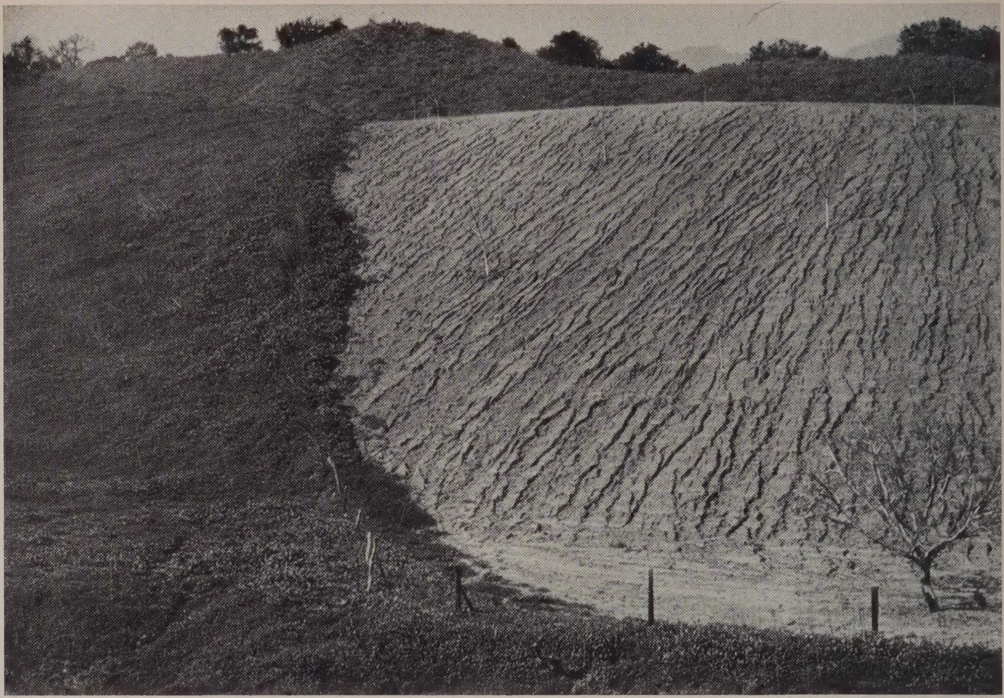
In the natural state these two processes, erosion and weathering, roughly balance each other. Like man and his skin, the earth imperceptibly sloughs off old soil while new soil is being created. The envelope is protected from the elements by a covering of trees, grass and plants; a cover which breaks the force of rain, shelters the soil from winds, and shields it from the baking action of the sun. Animals eat the vegetation, and return what they have borrowed to the soil. Men eat the animals and pick the fruits of vegetation. A balance and a harmony is thus maintained; each type of life has its allotted function in the natural scheme; no one species grabs an unfair share of the common heritage and so robs its fellows.

All cultivation entails the stripping of natural vegetative cover from the land and its replacement by some other form of vegetation. All cultivation, therefore, is to some degree a departure from the natural equilibrium, and therefore dangerous. But under primitive conditions, man can make little impression on the vegetation. He may clear small patches of forest, but as soon as he desists the trees will return; he may scratch at his plot in the valley, but he cannot live on a distant hillside when water must be drawn by hand; and because he cultivates to feed himself, he mixes and rotates his crops so that the land is nearly always covered by some form of crop.

Just as the invention of high explosives, of heavy guns, of bombs, of the internal combustion engine, has revolutionized man's power to destroy his fellows, so has the invention of the multiple-furrow plough, the tractor, the synthesis of nitrates, refrigeration and the whole elaborate structure of international trade revolutionized man's power to destroy vegetation. In both cases science has converted a localized and comparatively harmless activity into a world-wide and highly organized business which may threaten to destroy the very foundations of human



A cross-section of a field, showing the progressive loss of topsoil and final exposure of the subsoil due to sheet erosion



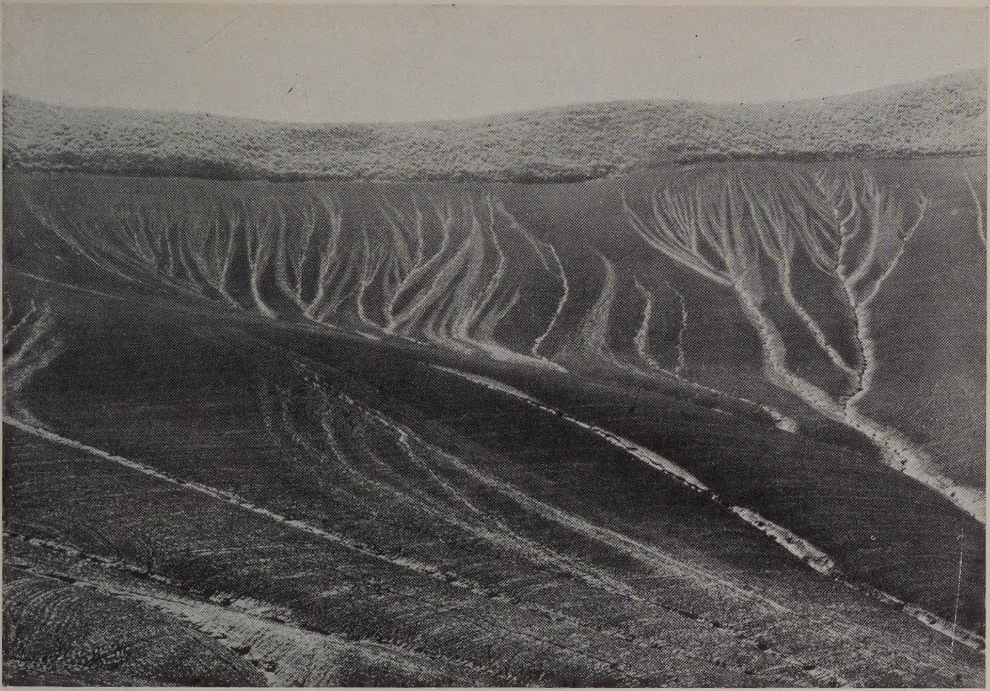
U.S. Soil Conservation Service

How erosion follows the removal of vegetative cover. After a single storm the bare land (right) *had lost 500 tons of topsoil per acre, the protected land* (left) *virtually none*

security. It has enabled him to make vast stretches of plain-land into playgrounds for the boisterous winds, and to strip the hills of forest as a man may shave a beard. Science has provided weapons to kill in millions where primitive man killed in hundreds, and to destroy forest and grass by the million acres where primitive man laboriously cleared a single acre.

The most striking modern examples of soil erosion are to be found in America. Before settlers came, half the present area of the United States was forest and one-third was buffalo range. Soil formation kept pace evenly with soil loss, and only 2·5 per cent of the total area was classed as desert. In the space of two or three generations, nearly one-half of all the forest has been cleared, and a large part of the great plain lying between the Rockies and the eastern chain of hills, once an unbroken sea of grass, is under the plough. Retribution has been astonishingly swift. A survey conducted recently states that 10 per cent of the total land area of the United States has lost more than three-quarters of its topsoil, that an additional 30 per cent (nearly 570,000,000 acres) can be classed as moderately eroded, and that about 4 per cent has had most of its topsoil blown away by dust-storms.

Erosion caused by rain-water is most acute where land is cultivated on slopes. In America it has been found that cultivation on a slope with anything over an 8 to 10 per cent gradient usually results in serious loss of topsoil, and it is recommended that such land should be kept permanently under grass. In experiments carried out in Oklahoma, Bermuda grass sod reduced the loss of soil to the negligible amount of ·038 tons to the acre in five



U.S. Soil Conservation Service

The beginning of gulley erosion, developing out of sheet erosion. Tributary watercourses lead, like fingers of a hand, into main channels which rapidly grow into broad, rocky gulleys

years: under cotton the same field lost 39·23 tons to the acre—670 times as much.

The amount of topsoil washed away every year in the United States can only be described as staggering. It is estimated, for example, that 400,000,000 tons of good, rich topsoil from the Mississippi Valley are swept annually into the Gulf of Mexico.

It has also been stated that in this area 25 per cent of all the cultivated land has now been stripped down to the subsoil, rendering it practically useless for growing crops. Measurements taken in the corn belt in Iowa showed that topsoil was disappearing at the rate of 60 tons per acre every year from cultivated land on slight slopes—a rate which, if maintained, would lead to the loss of the entire layer of topsoil (there it is only 7 inches deep) in twenty years.

The earlier stage of this washing away of soil by rain is known as sheet erosion. At a later stage it often develops into gulley erosion. Gulleys usually start as little creases in the surface of a ploughed field, miniature water-courses that serve as channels for surplus rainwater. They grow into huge gaping gashes which can no longer be cultivated and which encroach outwards year by year. This type of damage is estimated to have destroyed permanently over 4,000,000 acres in the United States.

Even so, sheet erosion is by far the more dangerous form, because it is for the most part invisible. The finer clay particles are carried away in suspension so that the soil becomes progressively more coarse and open, less capable of absorbing and holding rain-water and humus and plant food of all sorts. Its fertility, consequently, declines. Diminished yields are the first symptoms of sheet erosion. In parts of the corn belt of the Middle West, yields of maize have dropped from 35 or 40 bushels to the acre down to 5 or 6 bushels, in spite of the liberal use of fertilizers, within a single generation.

The farmer, thinking that the soil is exhausted, tries to remedy this by using more fertilizer. He may be partially successful, but only temporarily. The physical nature of the soil changes; it becomes so open that a heavy storm will wash out the fertilizer and a dry spell will cause the soil to bake and crack. Farmers begin to complain about droughts, but in truth it is not climate that has caused drought; it is man, who has weakened the soil's ability to cope with prolonged dry spells. There is no evidence to prove that the drought years which occur periodically today are any drier than they used to be, and a good deal to prove that they are not.

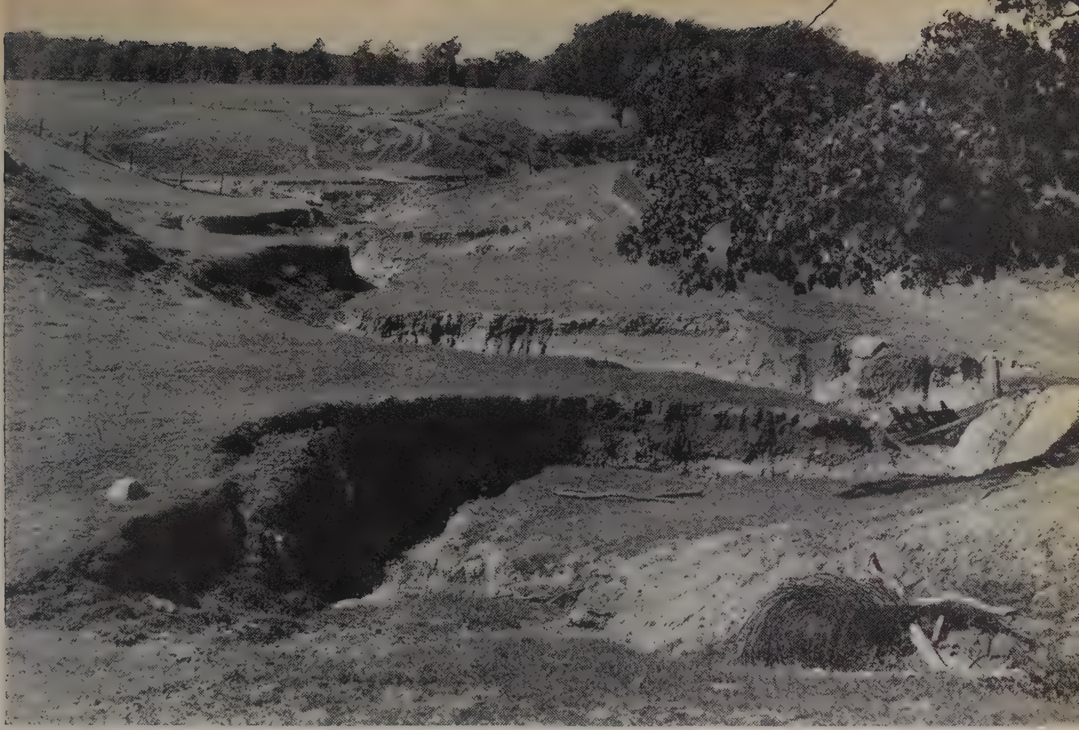
A coarse soil that is not bound together with organic matter, as soils in good heart should be, has no strength to resist the levering action of strong winds. Thus sheet erosion may lead to wind erosion, and to the famous dust-storms which made erosion headline news.

So much for the causes of soil erosion: now for the effects. These have already been referred to in general terms, but perhaps something more should be said about one aspect which is often overlooked, namely, the human aspect. For it is obvious that a decline in soil fertility will be reflected, sooner or later, by a decline in the standard of living.

This is, in fact, already occurring in parts of America. It has been pointed out that the first symptoms of soil erosion is a decline in crop yields. This means that farmers receive less money from the sale of their crops. The very marked decline in the income of the farm population of America compared with that of its industrial population, which formed the basis of President Roosevelt's agricultural policy, was partly due to this factor, although of course the principal cause was the low level of commodity prices. A direct attempt, largely successful, was made to raise commodity prices; but this was not enough. The Administration, acting on the assumption that you cannot base a rising standard of living on a falling level of soil fertility, is now building its farm policy on a nation-wide effort to restore and conserve fertility and so to increase the efficiency and therefore the income of the farmer.

There is a long way to go before this can be achieved: a huge semi-derelict farm population to be salvaged, and a number of drastic changes to be made in the agricultural economy of the United States. First, the semi-derelict population. We are familiar enough with this situation in Britain, but are apt to forget that it exists in no less acute a form in America. In our case the lost populations have been stranded by the retreat of industry; in America's they have been left high and dry by the retreat of profitable agriculture.

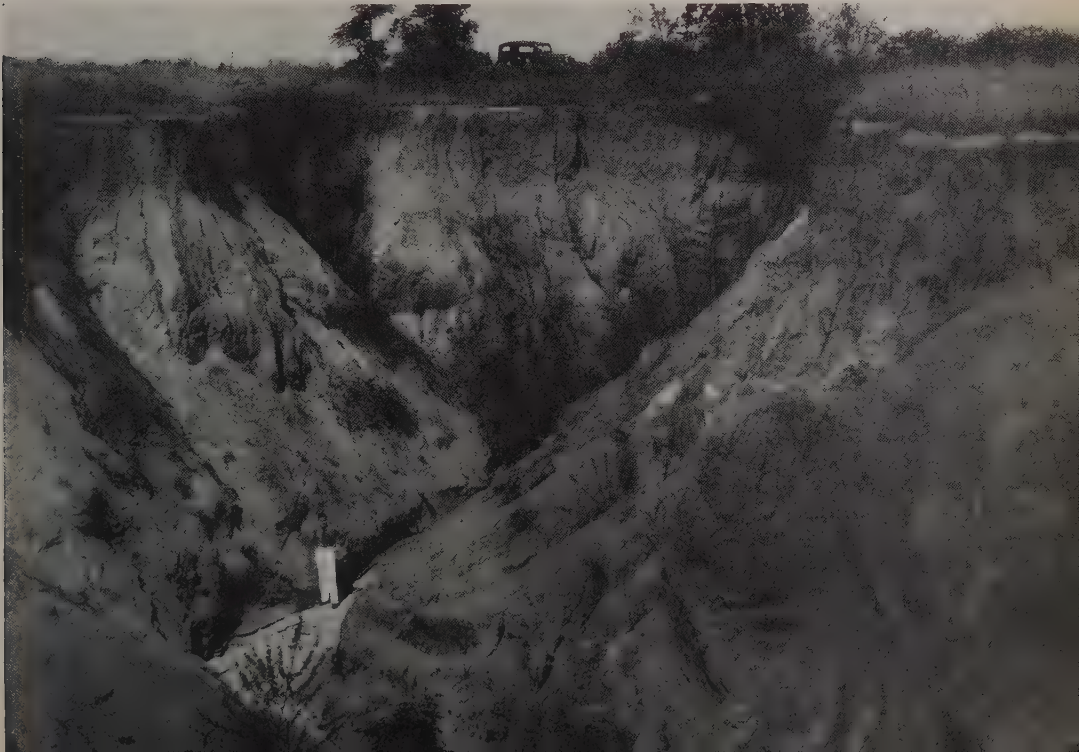
The United States 'distressed' areas are scattered everywhere: in the 'dust bowl', where whole communities have been forced to evacuate their disintegrated farms ('Bill Smith will be along soon—his farm went by half an hour ago' was a grim jest of the dust-storm epidemic); in the Pacific Northwest, where over-grazing has ruined large areas of pasture range and wheat-growing on unsuitable soil has led to the abandonment of a great deal of land; in New England, where villages once prosperous as centres of agricultural activity are now moribund and depopulated; above all in the South, where several million people live under conditions of extreme poverty and malnutrition, at or below what is known in America as the subsistence level. Over 15 per cent of the American farm population, nearly one million families, possess a total income, including the value of home-grown produce, of £80 a year or less.

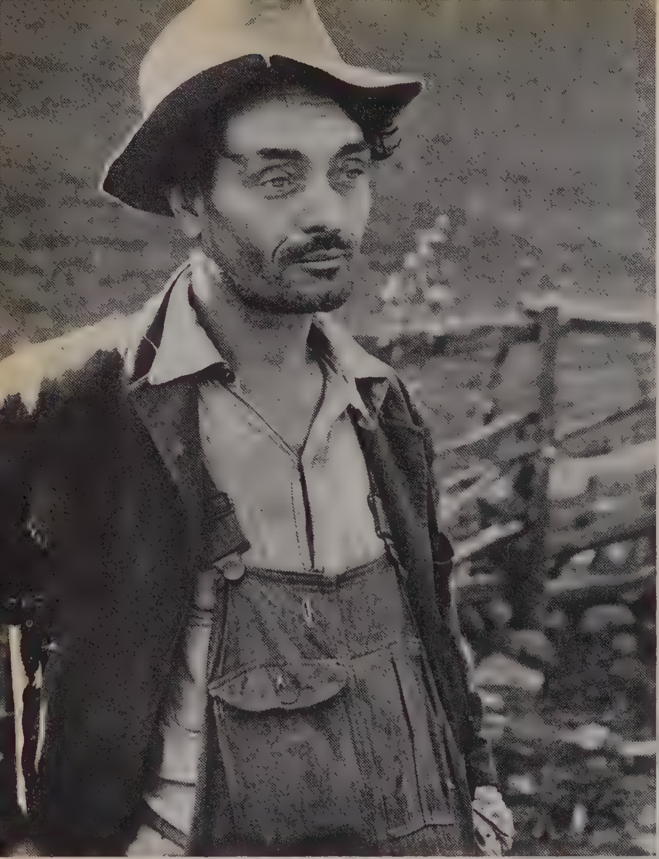


U.S. Soil Conservation Servic

From small beginnings such as are illustrated on page 303, gulleying progresses until the final stages here shown are reached. The basic cause is cultivation on slopes, without adequate control of surplus rain-water, to the action of which the soil is exposed by ignorant methods of farming

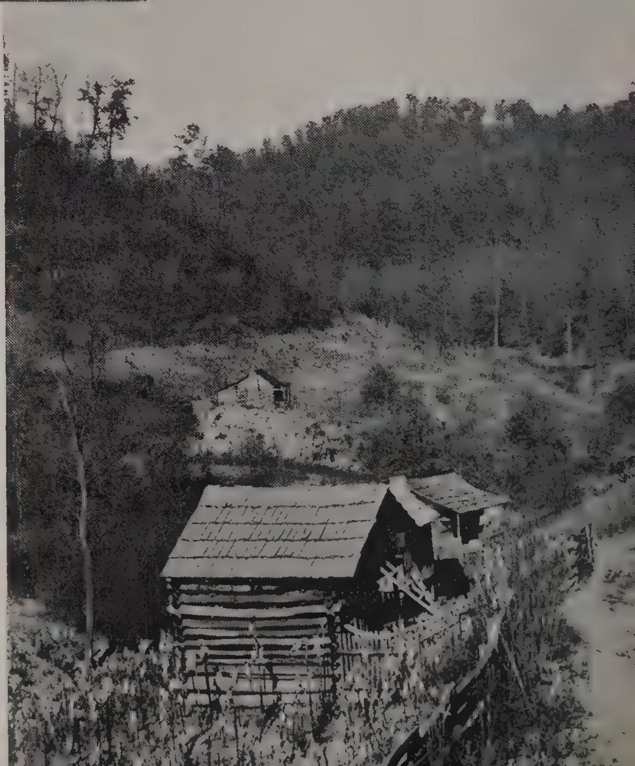
U.S. Soil Conservation Service





Elspeth Huxley

The steep slopes and poor soil of the Appalachian Mountains are particularly subject to erosion, and the 'hill-billy' descendants of early settlers who strive to wring a living from them are now condemned to malnutrition, ignorance and hopeless poverty



Elspeth Hux

Mountaineers' log cabins in Kentucky, among mountains that were intended by Nature to be covered with thick forest and not to support an agricultural population. The typical cabin has two rooms and often houses a family of ten or more people

It would be absurd, of course, to lay all responsibility for the poverty of the Southern farm population at the door of soil erosion. But it is undoubtedly one of the main causes. It is no coincidence that in the South, where rural poverty is greatest, erosion is also most advanced. Continuous one-crop cultivation has so exhausted the soil that yields have dropped to an uneconomic level; and the combination of a malignant method of cotton production, the so-called share-cropping system, of ignorance and of malnutrition has resulted in a population devoid of the incentive, the wish or the means to restore fertility by more enlightened methods of farming.

Perhaps the best example of a population reduced to a bare level of subsistence by the loss of soil fertility is provided by the 'mountaineers', inhabitants of the southern Appalachian Mountains which run from Virginia and West Virginia through Tennessee, Kentucky, North and South Carolina and down into Georgia. The modern 'hill-billy'—and there are said to be about six million of them—is descended from ancestors who stayed behind in the hills when their fellow-settlers went further west to open up the Mississippi valley and the great plains beyond. At that time the mountains were covered with thick forest and full of game. The settlers had no difficulty in living well off the harvest of the axe, the rod and the rifle. They were looked on as pioneers, but in truth they were beasts of prey who ruthlessly destroyed the wealth of nature. They denuded the forests of timber, they trapped and shot the woodland animals and even blasted fish from the rivers with dynamite.

When game and timber were exhausted, the mountaineers took to agriculture. They raised crops of maize and potatoes, kept pigs and hens. But the land was not, and is not, suited to agriculture. The soil is poor, the slopes are steep and yields are pitifully small. Now the land will barely support the families who cling to it; certainly it will not provide them with a surplus out of which roads and bridges, schools and hospitals, clothes and extra food can be bought. Consequently the mountaineers must go without. They live, for the most part, in two-roomed log cabins lined with leaves torn from mail-order catalogues, their sole possessions a couple of beds, a table, a few old chairs and, very often, an illicit still with which they make 'white mule'—crude corn whisky, their only cash crop. The children go shoeless; and hookworm is common. Often they grow up without proper schooling, and the percentage of illiteracy is higher than anywhere else in the United States. Children and adults alike live on an inadequate diet, and pellagra is not unknown. They cannot live better because the land cannot give them a better livelihood. They are the human victims of erosion.

Today the United States is paying heavily for the mistakes of its pioneers. It is paying directly in the cost of relief to farmers and ex-farmers who have abandoned their holdings or who cannot make enough out of them to support their families. It is paying indirectly in the huge cost of the Mississippi floods, both in repairing the damage and in trying to prevent its recurrence. It is paying in the loss of productive capacity of farm land, and in the cost of re-establishing on new farms the families who can no longer make a living out of those they have abandoned.

For this latter purpose the Government found it necessary, two years ago, to set up a special body, the Resettlement Administration. This agency has bought up and permanently closed to agriculture 10,000,000 acres of hopelessly eroded 'submarginal' land (according to the National Resources Committee, at least 100,000,000 acres need to be so bought up and written off the list of American assets); it has given the inhabitants of this 'retired' land a fresh start on new farms elsewhere; and it has

U.S. Resettlement Administration

The United States Government is battling vigorously against the decay of American agriculture and is spending, through the Resettlement Administration, immense sums in giving a fresh start to families ruined by erosion. A new farm community established by this agency in North Carolina

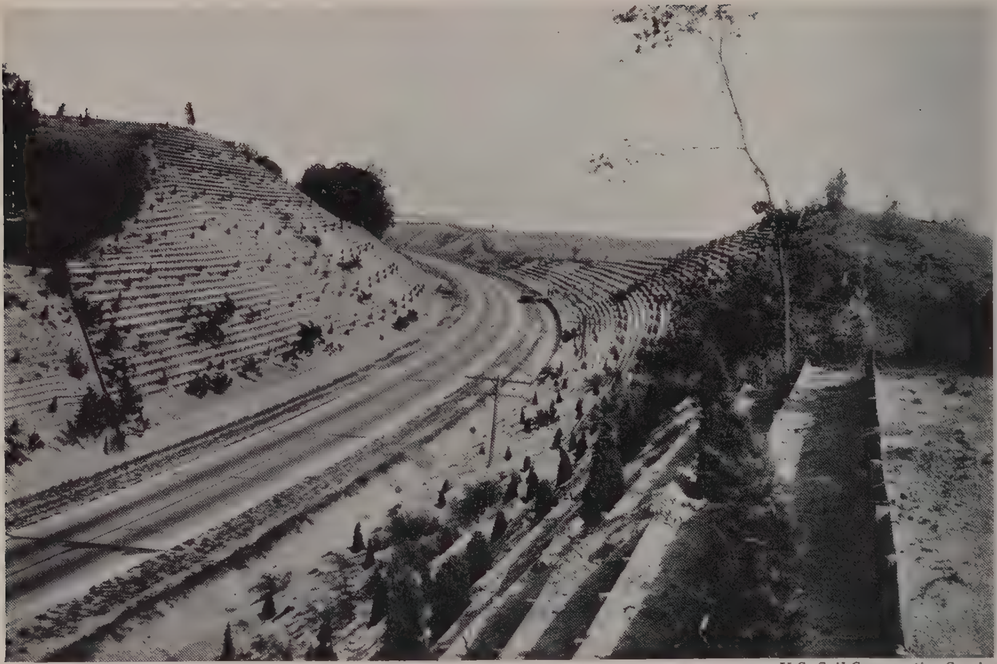
U.S. Resettlement Administration

A propaganda photograph for the Resettlement Administration: a 'resettled' farmer, transplanted from his exhausted soil and provided with new land, implements, seed, buildings and advice in a Government settlement, happily clasping a lamb and a hen as symbols of his restored confidence

U.S. Resettlement Administratio

Through the Soil Conservation Service, anti-erosion measures are being conducted all over the United States. (Above) *Where wind erosion hinders the natural regeneration of grasses, a covering of brushwood gives seeds a chance to germinate.* (Below) *Kudzu vine, planted in gulleys, prevents further wash*

U.S. Soil Conservation Servi



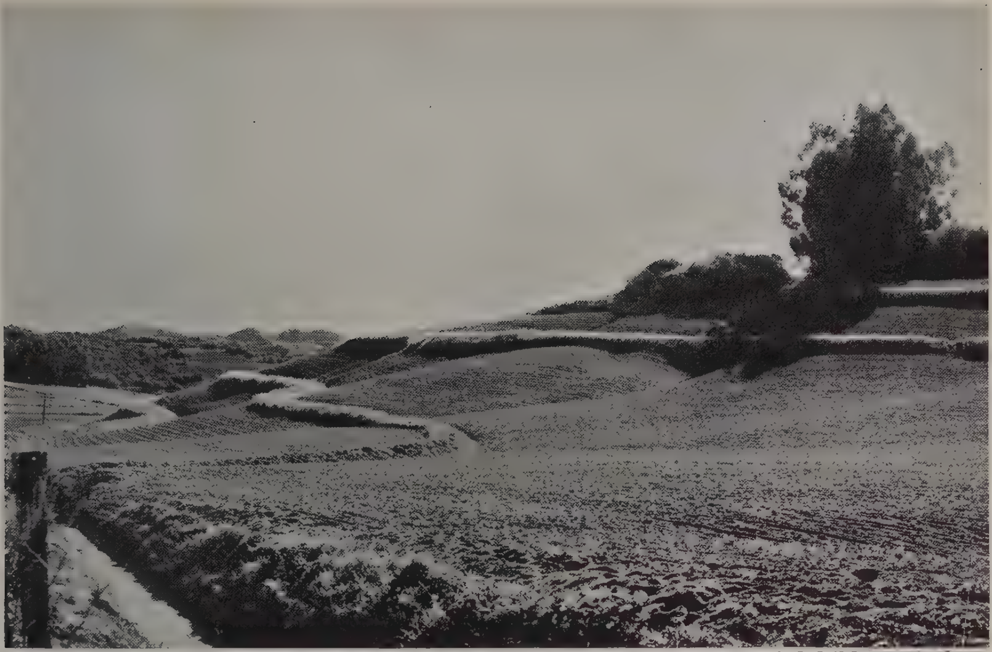
U.S. Soil Conservation Service

Terracing, the Old World's traditional weapon against erosion, is now widely employed in the New. Narrow 'bench terraces', supported with wood—a most expensive type—are used for the replanting of very steep slopes on valuable land

lent money to farmers in such desperate straits that they were unable to buy the next season's seed and fertiliser. This has already cost the country some £30,000,000. Another £5,000,000 a year is being devoted by the Soil Conservation Service to anti-erosion measures conducted all over the United States, and the Tennessee Valley Authority is also spending large sums on an effort to check erosion in the catchment area in order to prevent the rapid silting up of the power dams that are being constructed on the Tennessee and Cumberland rivers.

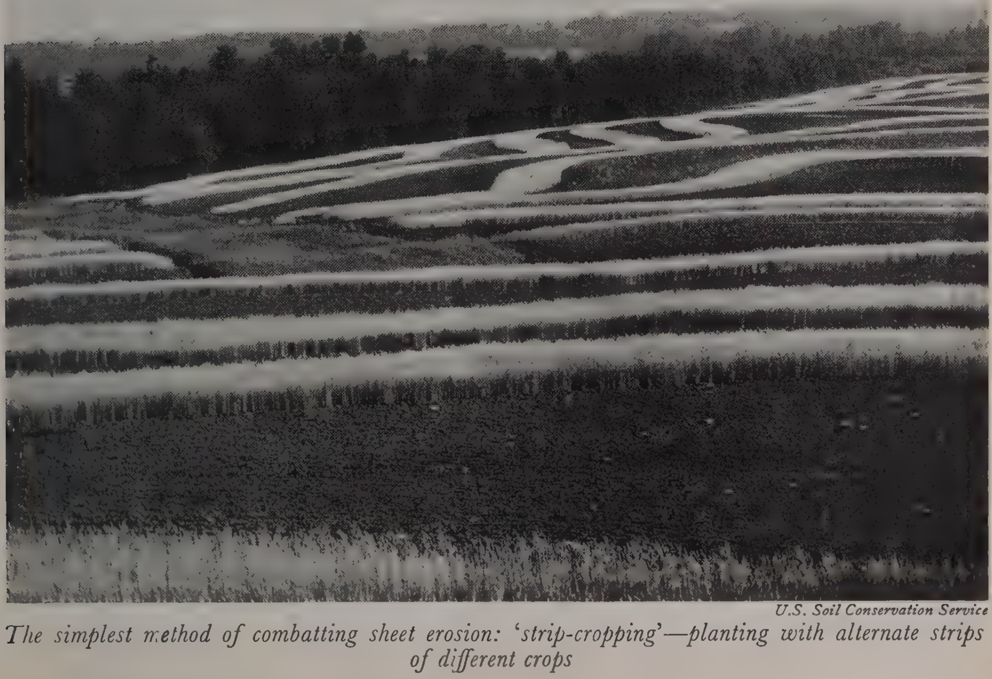
It has been stated, earlier in this article, that all cultivation disturbs Nature's equilibrium. From this it might be argued that since all cultivation is dangerous, in order to avoid erosion we should all revert to the hunting stage of man's history, living only on beasts and berries and clad in skins. Perhaps, to achieve a completely erosion-less world, we should. However, the situation is not quite as desperate as that. Erosion can be kept within bounds without resort to such drastic measures, and cultivation on a large enough scale to support man's needs still carried on. Erosion is not an act of God about which nothing can be done. It is a mistake of man which can be rectified, provided that it has not gone too far. It is only in the last few years that the gospel preached for a quarter of a century by a small group of men in the United States has spread to the American public, and it has still to gain acceptance in other parts of the world. America is now taking action with a vigour and thoroughness which suggest that the erosive process may not only be checked, but reversed.

There is no space here to deal with the



U.S. Soil Conservation Service

'Contour banking', a cheaper way of controlling slighter slopes. Surplus rain-water is caught in ditches which follow the contours. The banks behind the ditches are planted with some anti-erosive crop



U.S. Soil Conservation Service

The simplest method of combatting sheet erosion: 'strip-cropping'—planting with alternate strips of different crops various measures which can be taken to prevent erosion on cultivated land. The oldest and still the best is to step the slopes with terraces. Terracing has become a science, and the traditional hand-made terrace of Europe and Asia has, so to speak, spawned a variety of new kinds of terrace with different names and shapes. There are cheaper ways to control slighter slopes: strip-cropping, contour ploughing, making ditches and banks along the contours, and so on. Gulleys may be sealed with dams and their raw surfaces healed with creeping plants; eaten-out pastures restored by planting new grasses, regulating grazing and building dams; soil strengthened to resist attack by green manuring and the proper use of rotations.

The reorientation of farming so as to control erosion is likely to bring about certain fundamental changes in the economic life of America, and eventually of the world. One might almost say that since the discovery of the principles of soil conservation, agriculture in the newer countries will never again be quite the same. It cannot, for instance, be so completely individualistic. The idea that land is held in trust by the individual for future generations, is bound to find wider acceptance, and 'robber agriculture', the treatment of land as a mine to be exploited until it is exhausted, will have to go. As a corollary, systems of land tenure which encourage the exploitation of the soil will have to be altered so as to penalize it.

All anti-erosion campaigns at present being conducted in the United States involve the greater use of grass and legumes and the extension of mixed farming. If they are successful, therefore, American farming appears likely to swing away from cereal production and towards a greater output of livestock products. Already, in fact, America has passed from the ranks of the wheat-exporting nations to join the wheat importers; and she is unlikely ever again to export wheat on a big scale. On the other hand, she is likely to increase her output of meat, milk, butter and cheese to a point where she will need larger export outlets. If other countries do the same, economists and politicians of the future may have to grapple with the overproduction of livestock and dairy products.

Successful soil cultivation would mean the end of one-crop cultivation and the universal use, on arable land, of crop rotations. This would be bound to have a profound effect on cotton production in the South.

Soil conservation measures, if successfully applied, may further tend to shift the emphasis of American farming away from a cash-crop basis and towards a food-crop basis. In areas where the Soil Conservation Service is operating, it is persuading farmers to reduce their acreage under crops (which are all sold) and to put more land under grass for the support of livestock (whose products are largely eaten at home). The Government's aim is to teach farmers to be content to live well on their own land rather than to gamble on making a lot of money in a good season and to go short when harvests or prices fail. This idea, if it is accepted, should again tend to reduce crop surpluses available for export.

In general, therefore, the indications seem to be that a successful soil conservation policy would tend to diminish rather than to increase America's importance as a world exporter of farm commodities. Against this must be set the fact that good farming increases yields, and that there is undoubtedly very large scope for raising the output per acre, which is at present exceedingly low, of the American farm. There remains the further possibility that the soil conservation drive in the United States will not succeed in checking soil erosion. In that case yields, and with them exports, would be likely to drop steadily, and America, sooner or later, would be faced with the realization that she could no longer feed her own population.

By courtesy of the Australian National Travel Association.

lmost alone among the higher mammals, native to Australia: 'Yellow Dog Dingo'

Sydney Morning Herald and Sydney Mail

From 300 varieties of gum-tree (eucalyptus) Australia's landscape gains much of its beauty —

By courtesy of the New South Wales Government

nowhere more distinctive than in the wooded ravines of the Blue Mountains, near Sydney

Sydney Morning Herald and Sydney Mail

By courtesy of the Australian National Travel Association

Australia is the world's third largest exporter of wheat; while another promising item —

By courtesy of the Australian National Travel Association

— of her export trade, citrous and dried fruits, is nourished by vast irrigation works

By courtesy of the Australian National Travel Association

The memorial at Melbourne to the navigator Matthew Flinders, reputed to have named Australia

Australia's Flying Foxes

by F. N. RATCLIFFE

Mr Ratcliffe has been called upon to exercise his scientific, and particularly his biological, knowledge in the investigation of various Australian problems. Readers of the following article will await with interest the comprehensive account of his experiences off the beaten track in Australia, contained in his book Flying Fox and Drifting Sand, *which Messrs Chatto and Windus will publish this autumn*

FEW people realize that there are any mammals in Australia other than the pouched marsupials and the egg-laying duck-billed platypus—except, of course, the dingo and the pestilential introduced rabbit. The accepted theory to explain the wonderful variety of these primitive forms is that Australia has been isolated from the Asian land mass for a long and uninterrupted period of time. Thus the immigration of more highly evolved types was prevented; and the lowly marsupials were permitted to develop in peace, free from unfair competition.

Unfortunately the occurrence in Australia of a number of interesting little rodents rather threatens the validity of this orthodox explanation. Biologists, being only human, have on the whole evinced a marked lack of interest in these creatures, whose existence might almost be considered in bad taste. The presence of the dingo, on the other hand, is readily explained. This very typical dog is supposed to have been introduced by the aboriginals, and then run wild. The bats and seals (which with the dingo and the above-mentioned rodents comprise the whole of the higher mammal fauna of Australia) not being dependent for their migrations on land connections, offend no theories by their presence in the southern continent.

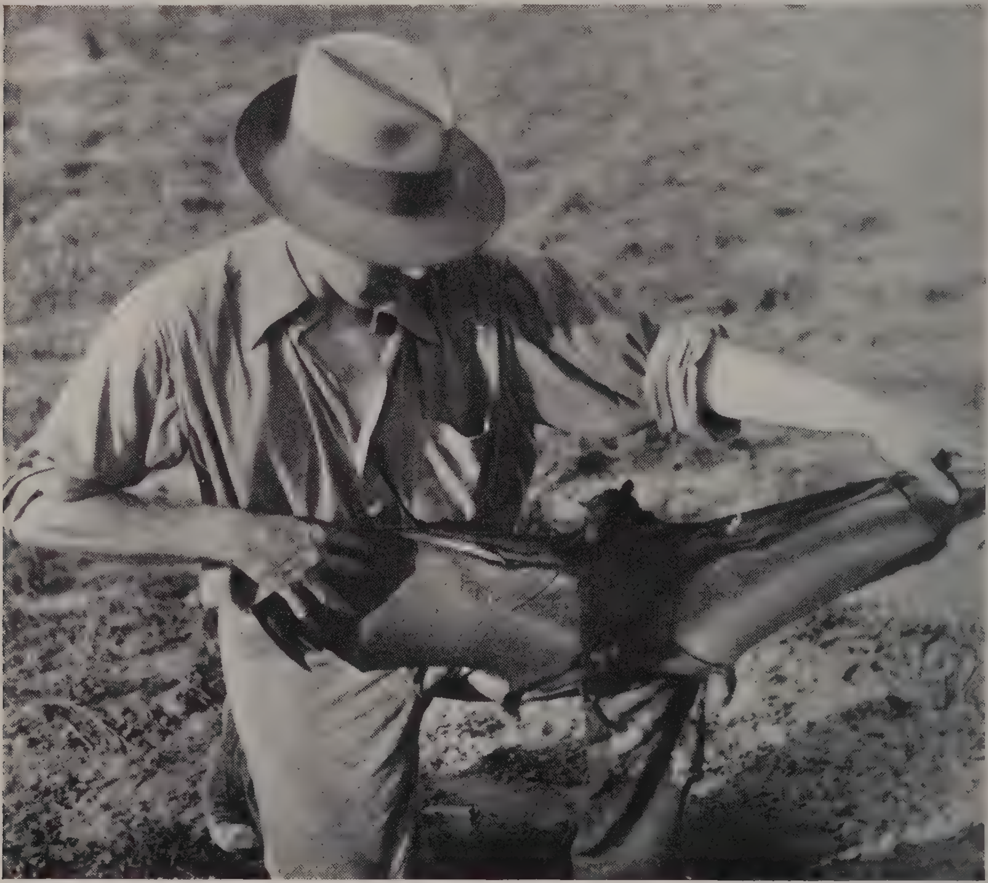
The bat fauna of Australia includes four species of the genus *Pteropus*, known as fruit-bats, or more popularly as flying foxes. These differ slightly in their habits and considerably in their geographical ranges. I met the first on the side of a jungle-covered mountain south of Brisbane; the second in the mangrove swamps at the mouth of the Burnett River; the third I did not see until I had penetrated the tropics as far north as Cairns; while the last I shot one moonlight night within sound of the Pacific breakers, as it fed on the heavily scented blossom of a ti tree.

They are enormous creatures, as bats go. The two larger species sometimes exceed four feet from wing tip to wing tip (though they are outclassed by the closely allied Javan 'kalong', *Pteropus vampyrus*, which may have a spread of over five feet). Possibly it is on account of their size and the reddish colour they so frequently favour that they have been called flying foxes. Alternatively the name may have been suggested by their sharp, intelligent-looking, fox-like faces.

The flying fox can justly claim to be a foundation member of the recognized Australian fauna, for at least one specimen was seen and recorded by Captain Cook during his voyage up the east coast in 1771. A sailor from the *Endeavour*, walking through the forest near what is now Cooktown, came on a flying fox, funnily enough crawling on the ground (for like all bats they never land on the ground if they can help it). "It was", Sir Joseph Banks' Journal reports him as saying, "as black as the devil and had wings, indeed I took it for the devil, or I might easily have catched it, for it crawled very slowly through the grass."

There are very few living creatures so specialized in the matter of limbs as are the bat tribe; and they have paid the price in their helplessness. Their fore-limbs have been fashioned into wings, with long fragile bones supporting delicate flying membranes. Their hind legs have become rotated at the hips until their knees bend backwards; while their feet have degenerated into little more than groups of suspensory hooks. It is virtually impossible for bats to take wing from anything but a high perch; and they never alight on the ground except as the result of an accident. Yet considering their handicaps, they manage fairly well. One digit, the thumb, has remained free of the flying membrane, and is movable. With the aid of their thumbs, which are clawed, flying foxes can clamber about the branches with surprising agility. The thumbs, moreover, are used to hold food, and also in the noisy sparring which they constantly indulge while hanging head-downwards in their 'camps' (of which more anon). Incidentally the wings are employed as fans when the weather is hot, as mackintoshes when it is wet, and as a protection for the young when hanging beside their mothers.

Flying foxes breed but once a year; and a single young one is the rule, although twins have been recorded. The infant foxes are carried by their mothers on their nightly wanderings. They cling closely to their parents' breasts and fur with their wings and feet and mouths. When, how-



All photographs by F. N. Ratcliffe

Of the four species of 'flying foxes' that frequent the coastal forest belt of Eastern Australia, and have gained notoriety as orchard raiders, the Pteropus Gouldi *is one of the largest*

The descent of some thousands of these bats upon an orchard may prove disastrous for its owner; but luckily they seem to prefer forest flowers to orchard-grown fruit, unless overripe

ever, they have grown so big that they are a real burden, they appear to be left behind in the camps. It is then that pythons, probably the flying foxes' deadliest enemies, take their heaviest toll.

Other natural enemies of the flying fox are eagles and the bigger owls (although the latter would probably hesitate to tackle a fully grown fox, which has sharp teeth, and will fight desperately when cornered). The large monitor lizards—'goannas', as they are always called in Australia — regularly haunt flying-fox camps; and perhaps manage to pick up an odd one now and then, for they can climb like squirrels. In the regions where they occur crocodiles apparently account for a good many flying foxes, snapping them up as they fly down to the water to drink, like swallows, on the wing. The stomach of a crocodile shot in north Queensland in 1930 was found to contain as many as twenty-four flying foxes.

White men, rather understandably, are nauseated by the very notion of eating bats; but those who from desperation or curiosity have been led to make a meal of flying-fox flesh have usually declared it quite palatable. It is considered a luxury by the aboriginals, who in some districts made and used special flying-fox spears (very light and long, with four barbed prongs) for catching them on the wing. Flying foxes have saved the life of at least one Australian explorer—Ludwig Leichardt, who had to depend on them for food on his, the first, overland journey across Queensland, in 1848.

By 1929 a considerable number of odd facts about the natural history of the

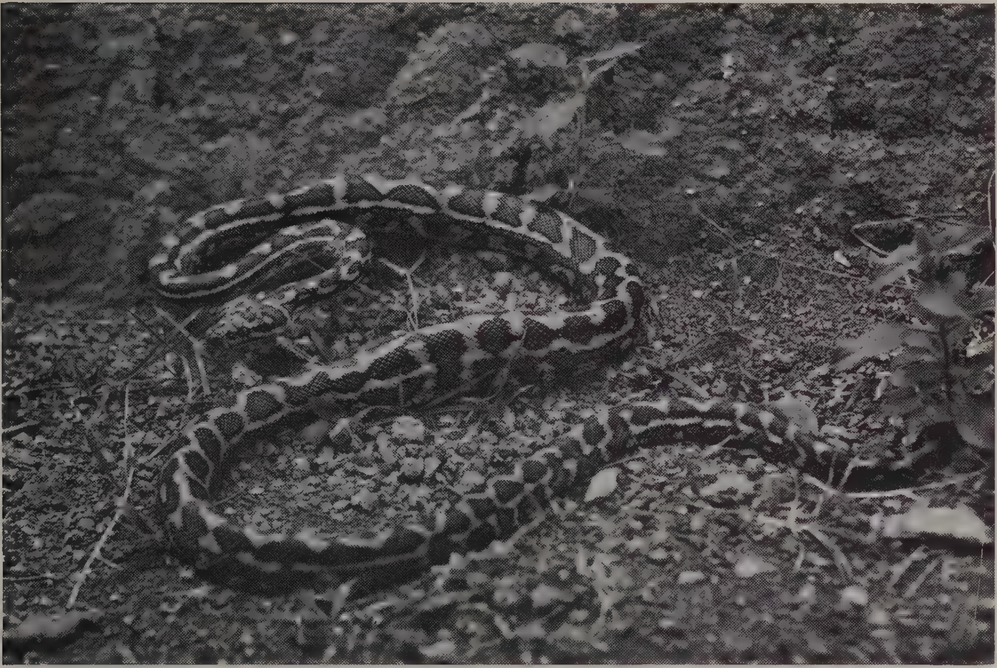
Australian species of flying foxes had been accumulated, but anything like an accurate picture of their population as a whole and what might be called their economy was conspicuously lacking. The task of providing such a picture fell to my lot as a result of their depredations in fruit orchards, which in the opinion of some growers called for government action against them. I was required to collect information as to the numbers and range of the animals, their movements (they were known to be migratory to some extent), their feeding habits, powers of multiplication and natural enemies, and finally the true extent of the economic damage which they caused.

A study of the geographical ranges of the four Australian species, and of their closest relatives in other parts of the world, indicates that flying foxes colonized Australia from the Austro-Malayan islands lying to the north. And they have proved exceedingly successful colonists. Flying foxes are essentially tropical animals; and their natural habitat is the jungle, which provides them with shelter during the daytime, and food in the form of fruits. Australia has its damp tropical belt and areas of genuine jungle; but the flying foxes have spread far beyond these. They have found their way south into the temperate regions, and have learned to forage in the 'open' forest, the characteristic Australian eucalyptus parkland: grass country more or less lightly sprinkled with trees. Here their food is not fruit, but the nectar of flowers.

The monitor lizard or 'goanna', which attains a length of over five feet, is a sufficiently expert climber to capture flying foxes at roost

It is to their adaptability in the matter of diet that the flying foxes' outstanding success in Australia is largely due. When they decided to turn themselves into blossom feeders an almost limitless supply of food became available to them; and making full use of it they built up and maintained a vast population. They still eat fruit when they can get it, and are at times a great nuisance in orchards and plantations; but their main source of food is the blossom of the eucalyptus trees.

It is only by studying the daytime 'camps' or 'rookeries' that the real size of the flying-fox population can be estimated. These are found mostly in patches of jungle or mangrove swamp, and may cover an area of several acres. Actual counts made in camps indicate that an acre of typical jungle normally accommodates some ten to twenty thousand bats, without apparent crowding. On this basis it was estimated that some of the larger camps found in Queensland contained upwards of a quarter-of-a-million individuals (some unusually large ones in the far north perhaps approach the million mark); while a 'mob' of anything less than five or ten thousand must be considered small.

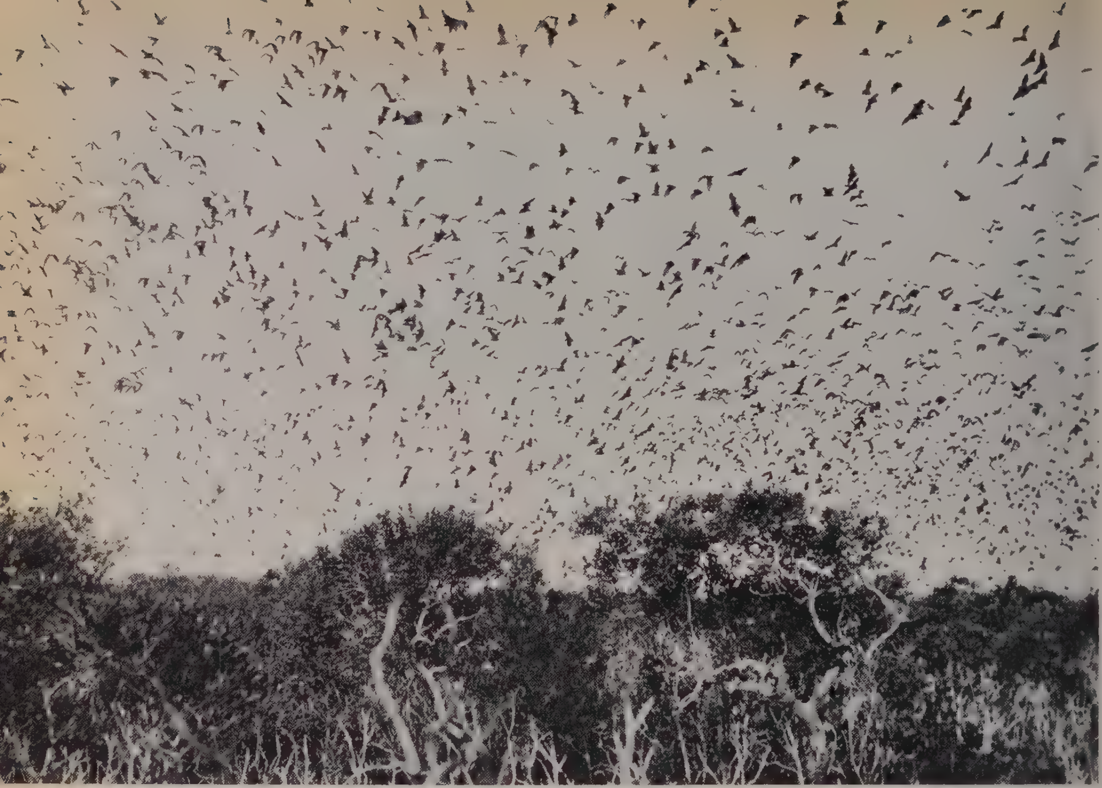


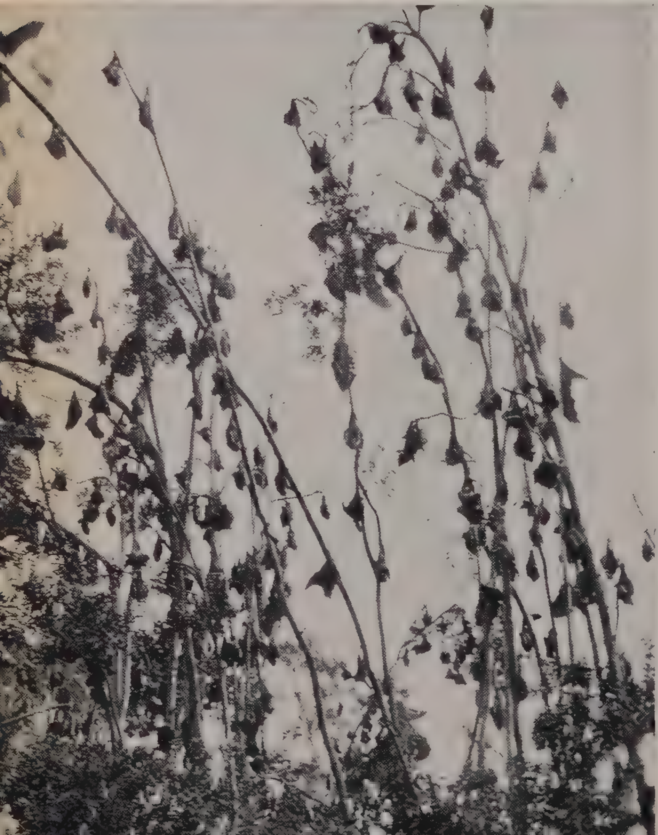
The carpet python is probably the flying foxes' most formidable natural enemy, killing great numbers of their young in the camps before they can fly well enough to accompany their parents

Camps are, practically speaking, limited to the purely coastal belt, that is to say within fifty or sixty miles of the sea. The intervals between them are rarely as much as twenty-five or thirty miles. Thus the enormous size of the flying-fox population of the thousand or so miles of eastern Australia's tropical and subtropical coastline can be well imagined.

The evening flight from a large camp provides a truly magnificent spectacle. The bats begin to get restive and noisy as soon as the sun has set; and they will usually leave the shelter of the trees while the evening light is still in the sky. The exodus may last well over half-an-hour, when the forest appears to belch forth clouds of foxes as a burning building belches smoke. Usually one or more columns will be formed which string away in different directions bound for feeding-grounds several miles distant. To an observer standing under one of these great flights the sky appears to be blotted out. The air is filled with the roar of beating wings; and if the night happens to be damp and still, the musky smell of the creatures may permeate the atmosphere.

Another thing that has been a factor of importance in the flying-foxes' success in Australia is the migratory habit. They probably manifest it to some extent in all the countries in which they occur; but there is no record that anywhere else do the creatures indulge in regular long-distance migrations, comparable with those of birds. One of the four Australian species, the so-called grey-headed fox (*Pteropus poliocephalus*), has succeeded in establishing itself, by virtue of its migratory habits, far beyond the limits of the tropical and subtropical zone. In winter it is not normally found south of the Tropic of Capricorn. With the approach of

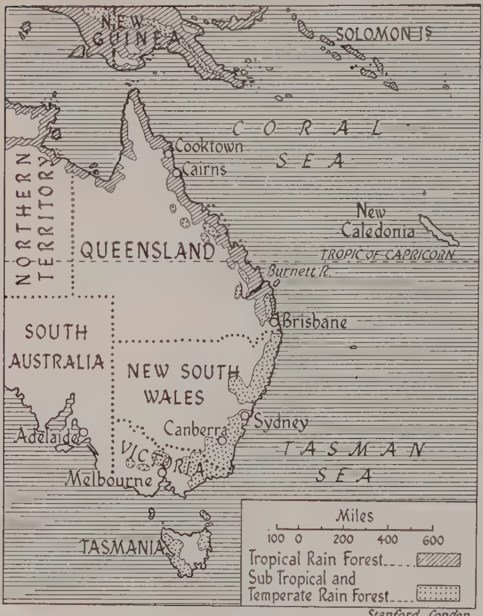




The flying-fox 'camps' are found in jungle or mangrove swamps at intervals of not more than thirty miles along a thousand miles of Australia's eastern seaboard. When disturbed, the bats fill the air with the roar of their wings

These daytime roosting-places may contain from ten to twenty thousand bats per acre, and perhaps a quarter of a million bats may return to one of them year after year. The tree-tops are, in consequence, often stripped bare

A mangrove swamp on the Queensland coast: the site of a flying-fox camp



Stanford, London.

summer, however, a mass migration begins; and the camp sites down the coast become occupied one after another, from north to south, until the wave dies out somewhere near the Victorian border. In some years a few foxes even succeed in reaching Melbourne; while there is one (rather doubtful) record of a grey-headed fox from Tasmania. It is an interesting and probably significant fact that *Pteropus poliocephalus*, the only species which regularly invaded the temperate regions, has much denser and longer fur than its less enterprising relatives.

Flying foxes will never be more than casual invaders of the inland country. The absence of surface-water presents an insuperable obstacle to them. The coastal belt, however, two thousand odd miles from north to south, is ranged by a vast and shifting population of these bats, secreted during the day in out-of-the-way swamps and pockets of rain forest, and spreading over the countryside every night in search of food. They follow the blooming of the eucalyptus and seem to be aware of the ripening of every wild fig in the jungles. Neither do they overlook the possibilities of the man-made plantations and orchards. Luckily for the fruit-growers flying foxes seem to rate the forest flowers more highly than man's artificial products, so that orchard fruit is usually more or less immune if there happens to be a good crop of blossom in the locality. Luckily also, the bats prefer their fruit to be fully ripe, and thus most of the commercial crop is safely picked and packed away before it has attracted their attention. In the wide area over which the creatures are found, the orchards and plantations are like insignificant dots in the great expanse of eucalyptus forest, especially in Queensland. Moreover, the white head of a big gum tree in full bloom probably contains more flying-fox food than a whole acre of orchard—provided that the crop is punctually gathered.

Thus seen in proper perspective, the flying-fox problem takes this shape. The trouble-makers turn out to be a tiny minority of a huge and mobile population. As it is impossible to distinguish the actual culprits (unless caught in the act), and as every individual flying fox is a potential orchard raider, a campaign against them would have to be general. From a knowledge of their numbers, their habits and their haunts, it is impossible not to come to the conclusion that such a campaign would almost certainly prove to be a waste of both time and money. Luckily, however, all the available evidence points to the fact that the flying-fox population of Australia is in the process of a fairly rapid natural decline, which must surely result in a gradual decrease in their economic importance. 'Natural', perhaps, is hardly the right word to use, for the principal cause of the great reduction that has taken place in their numbers is undoubtedly the increase of human settlement, which has involved the clearing of the jungle and the ring-barking of the eucalyptus forest over hundreds and thousands of square miles.

The Changing Face of Moscow. II

by KYRIL GRIBKOV

From the pre-revolutionary development of Moscow, described in our July issue, the author, a young Russian architect, turns to its enormous expansion since it became the capital of the U.S.S.R. and to the comprehensive plan governing the reconstruction now in progress. In the light of this example, and of the scarcely less impressive transformation of Rome (see The Geographical Magazine *for January 1937), dwellers in our relatively planless cities may well ask themselves whether it is not time that we made up our minds to overcome the obstacles which prevent positive, constructive planning in England*

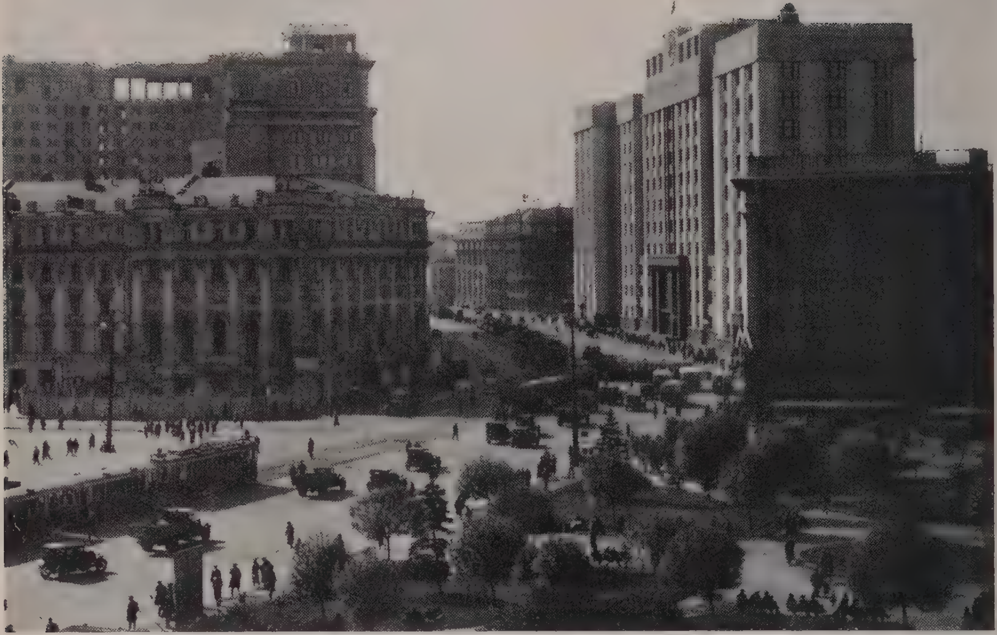
OLD Moscow, primarily a trading and residential town, was known as 'Calico City', owing to its all-important textile industry. Such a definition can no longer be applied. Moscow has now become the greatest machine-producing centre of the U.S.S.R. A quarter of the total output of the Soviet metal-working industries bears the trade mark of factories built in Moscow for the manufacture of cutting and measuring instruments, electrical equipment, excavators, bicycles and watches. All the wheels of the country revolve on Moscow ball-bearings. Moscow-made lorries can be seen in every part of the Soviet Union. The capital has ceased to be an octopus sucking the life-blood of the country. It has become a dynamo, generating energy for all the surrounding regions.

Moscow has also become a great scientific centre. The Academy of Science has its quarters there, as well as scores of scientific institutions. On the bookshelves of the Lenin Library stand some six million volumes. In 1934 Moscow was already publishing 750,000 copies of books daily.

Moscow has 162 universities, higher technical schools and special academies, with an aggregate of 130,000 students. (In the whole of tsarist Russia there were only 113,000 students.) The network of technical educational institutions has been specially developed. The students in them include Kurds, Uzbeks, Bashkirs, Kabardinians, Armenians, Yakuts. Moscow is training the personnel with which to vanquish the elements, to conquer the ice of the Arctic, to build new factories and cities. Moscow has 566 primary and secondary schools, in which instruction is given to 549,600 pupils. By 1938 there will be 244 additional schools. Moscow school children receive hot luncheons at the schools every day. A compulsory ten-year course of education was introduced in 1935. The school-leaving age is 17.

The European Press has often referred to Moscow as 'the theatrical capital of the world'. Since the Soviets came into power, 46 new theatres have been created in Moscow, in addition to the 14 repertory theatres in existence before the revolution. Moscow was the first of Soviet cities to create a wonderful Park of Culture and Rest, which covers an area of 750 acres. Of this park, Mr H. G. Wells wrote in the visitors' book on July 23, 1934: 'When I die to capitalism and rise again in the Soviet heaven, may I wake up first place in the Park of Culture and Rest'.

Modern Moscow is no longer the sprawling village it was a few years ago. The Socialist capital is going through an effervescent process of reconstruction, removing the last remnants of its dark legacy. Even now one outstanding difference between Moscow and great capitals elsewhere is obvious to a casual visitor—there are no slum quarters. Walk for hours and hours from the centre in any direction and you

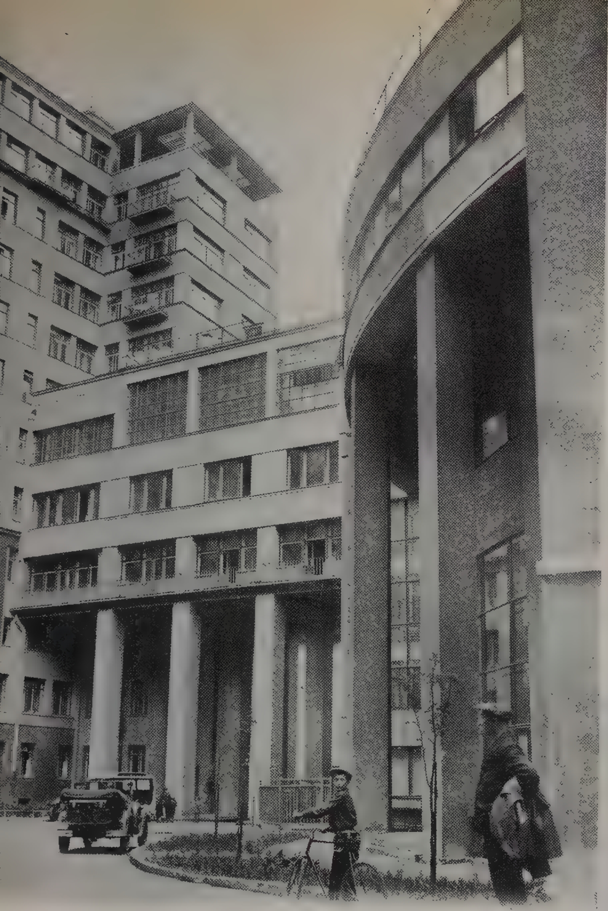


Many of Moscow's traffic arteries converge on the Sverdlov Square, beyond which may be seen (left) *the Moscow Hotel and* (right) *the Council House of the People's Commissars, both recently erected*

won't fall down any social precipices. Geographical distance does not convey social distance. You will not find insanitary side-streets that offer a shocking contrast to palatial mansions on the broader thoroughfares. The streets in the working-class wards are well lighted and asphalted, the shops are well supplied and these districts have their own palaces of culture and theatres. In the plan for the reconstruction of Moscow, it is especially on the outskirts, where the combination of green spaces and water is most abundant, that the most beautiful effects are provided for.

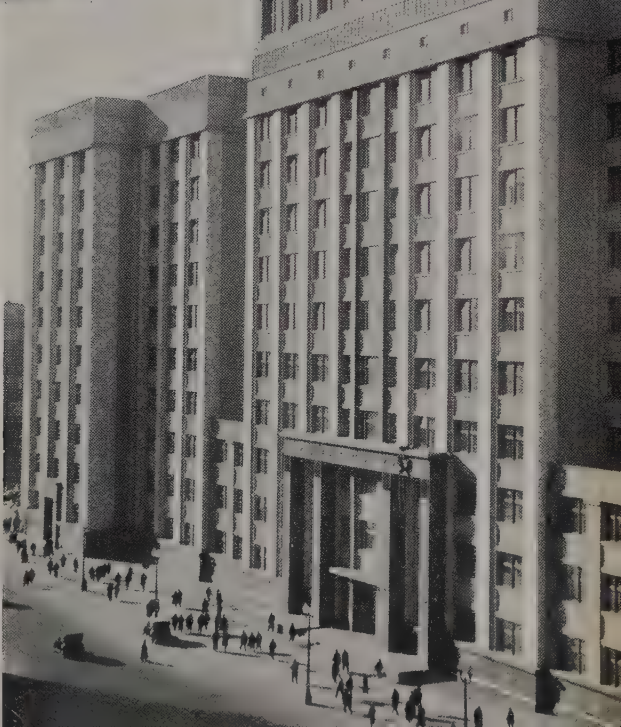
The population of Moscow during the last five years has increased by a third and now numbers 3,640,000. New York and Chicago even during the years of their most vigorous development did not grow at such a rapid rate. In order to limit the population, since 1932 no large works and factories are, as a rule, being built in Moscow. The increase of population is not only caused by the influx of new labour strength from the country. In Moscow the natural increase of population is very high. To every thousand of population there are 21·7 births and 12·9 deaths per annum, which means a natural increase of 8·8 (in London it is 1·9). State and municipal expenditure on infant welfare and public health during the last decade has increased enormously.

The building of new houses has not been able to keep pace with the growth of the Moscow population. In 1931 Moscow possessed 56,000 dwelling-houses, of which two-thirds were wooden structures. From 1931 to 1934, 1850 large new houses were built—more than in the whole of the decade preceding the revolution, when Moscow

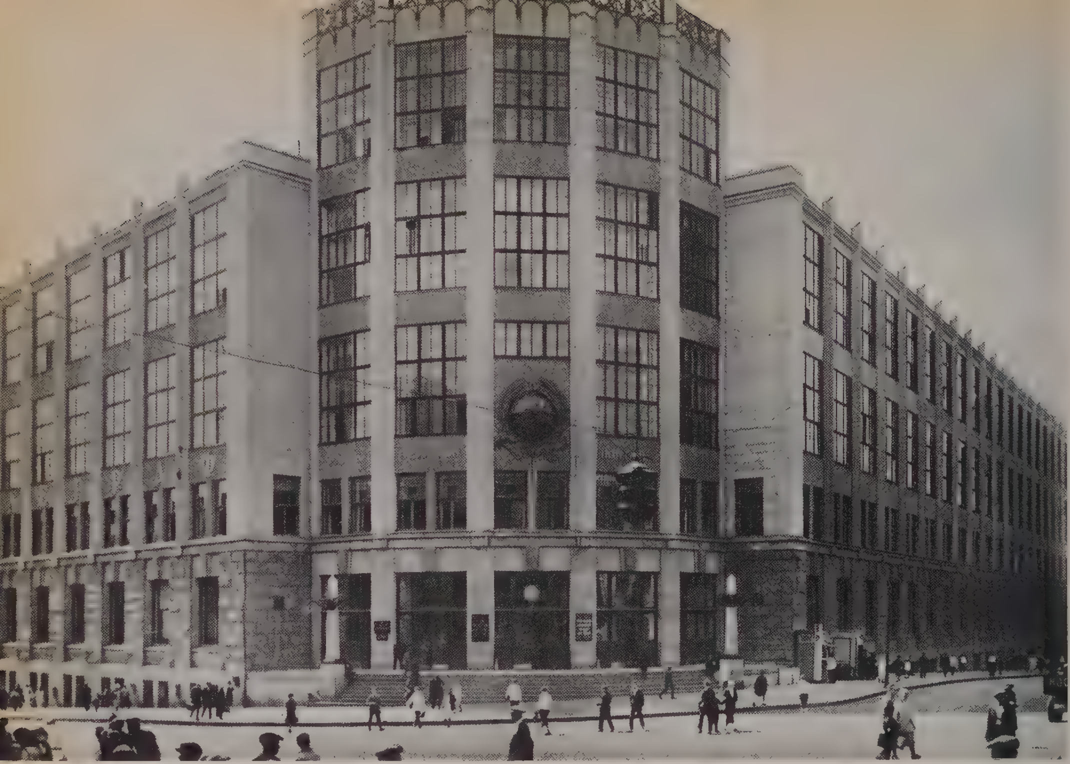


A detail of the 'First House of the Soviets', designed by the architect Ioffan. Its strict 'functional' style, characteristic of architecture in the U.S.S.R. a few years ago—

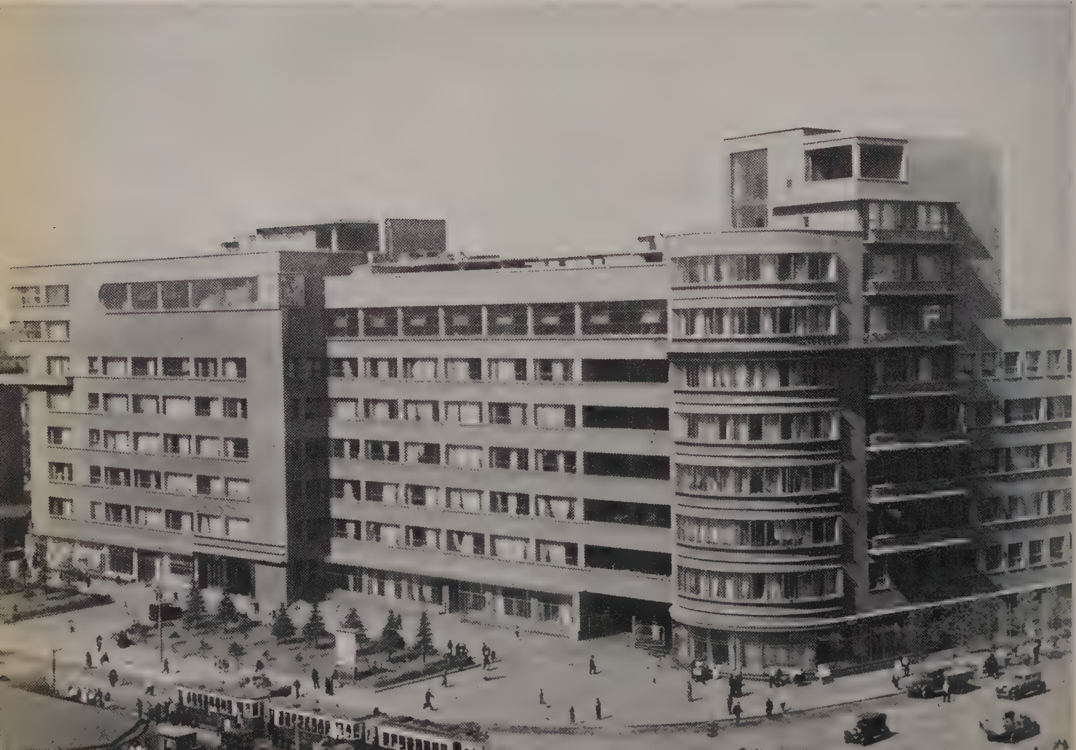
Plane



—is now tending to be abandoned in favour of the more decorative manner exemplified by the Council House of the People's Commissars in the Okhotny Ryad, completed within the last two years



The Moscow City Soviet has entrusted the design of new buildings to nine 'ateliers' of architects, each under a distinguished leader. The resulting variety within the general plan is seen by comparing the Central Telegraph Building (above) *with the People's Commissariat of Agriculture* (below)



Soviet principles ordain that every man shall be paid 'according to his work'. Sufficient inequality of income thus arises to provide customers for goods not universally available, and to justify shop-window displays—

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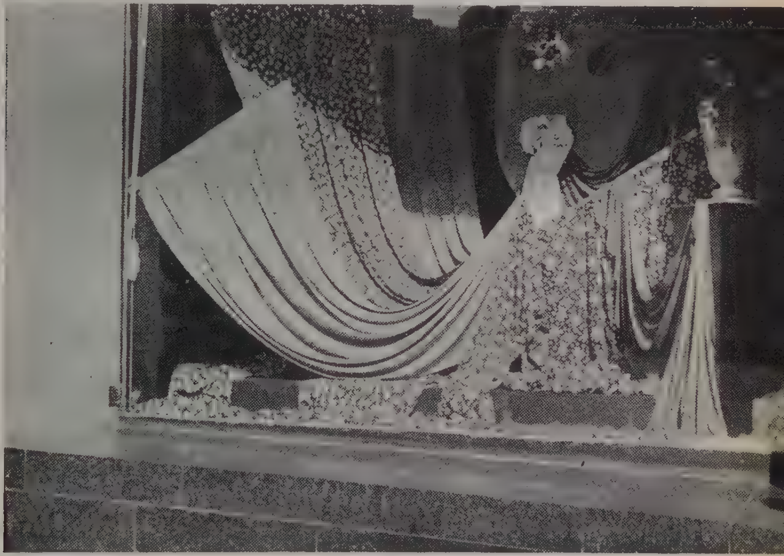
—which advertise to the more highly paid citizens of Moscow the less widely distributed products of the State factories; among them women's dress materials of the finer qualities, arranged with an art reminiscent of Bond Street—



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—and confectionery, as attractive, in its ribbon-bedecked boxes and coloured containers, to Muscovite children as to their contemporaries in 'capitalist' lands. With such luxuries the State rewards those who succeed in raising themselves above the rank and file

J. Allan Cash

In Moscow streets one still encounters that lingering representative of private enterprise, the izvozchik, *who confronts with his ancient* droshky—

enjoyed a period of great prosperity. But all this was not enough.

The approved plan for the reconstruction of Moscow provides for a doubling of the dwelling-space—in ten years a second Moscow will be built. Old two-storeyed houses will be demolished and replaced by residential blocks not less than six storeys high. The population will be housed in a smaller area and this will permit roads to be widened, and gardens, sports grounds and avenues to be constructed.

Hitherto Moscow had grown without a plan, swallowing up the surrounding villages. The radial streets leading to the centre had grown excessively long, while retaining their crooked and narrow characteristics, and they drew all the traffic from the 2500 streets of the city into two squares—Teatralnoi and Lubyanskoi. The centre became over-congested. The heart had ceased to respond to the organism. A hardening of the arteries of transport had set in. Auto-buses and trolley buses, often driven by young women, came to the aid of the tramcars. But the problem of the city's transport could not be solved thereby, and Moscow began the building of the Metro.

The first section of the Metro, about 7 miles in length, was opened in May 1935. When the construction of the Metro was begun in the depths of the stagnant soil of Moscow, the old streams came to life. Two underground rivers, the Olkhovka and Neglinka, often flooded the pits with water and quicksand. These streams had to be enclosed in new concrete conduits. In many places, particularly under Mokhovaya Street where old marshy strata were struck, work had to be done in coffer-dams under compressed air. The air forced out the water and drove out the quicksands. In the northern part of the line, water-logged strata were conquered by freezing the soil. An important official of the London Underground, in an interview, expressed the opinion that if London had had the same subsoil as Moscow, the British capital would still be without an underground railway.

A new Metro line is under construction, and in 1939 Moscow will have 22 miles of underground network. 200,000 Muscovites travel by Metro daily. It was built for the owners of the country and by people for whom human beings come first. This is why it is so comfortable, so roomy, so good to look at. It gives courage to those going to work, rest to those coming back. Every station on this Underground has its own colour scheme, frescoes, sculptures, coffered ceilings.

Some 'overtones' of that technical effort seem essentially new and impressive to the more perceptive strata of foreign sightseers. Mr John Middleton Murry writes in the *Adelphi*, in December 1935:

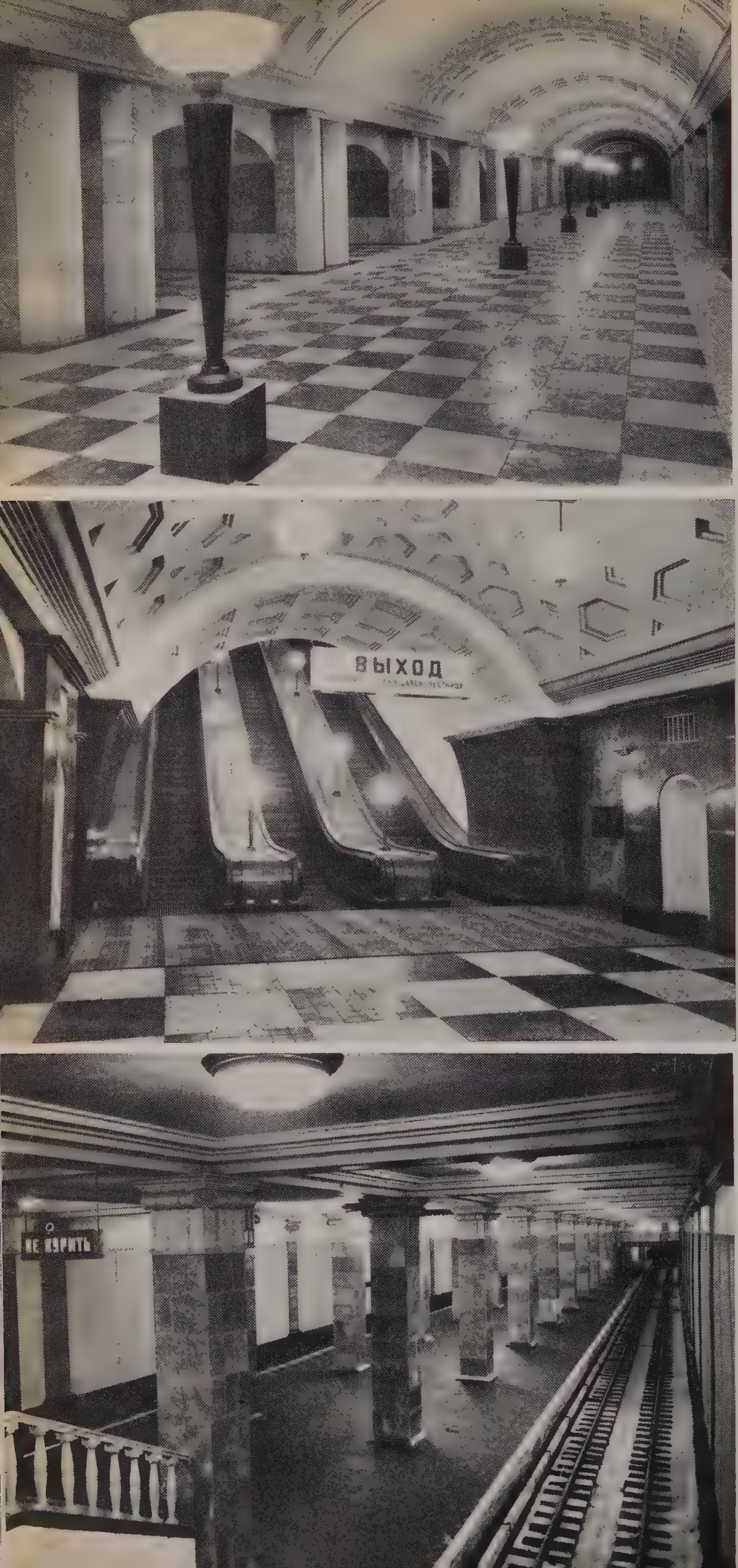
> The communal spirit which built the Moscow underground railway probably was the *true* modern equivalent of the communal spirit which built the noble 14th-century cathedrals. There was the same corporate joy in the work, the same pride in it, the same belief in its necessity. . . . In so far as a cathedral is an expression of a people's life, and not a mere type of architectural construction, like a Union railway station, or a power house, I do really believe that the Russian people today is the only people capable of building a true cathedral, the only people in a condition to build one—only their cathedrals are not churches.

* * *

In 1935 was approved the gigantic plan for the complete reconstruction of Moscow during a period of ten years. The plan is based on the historically evolved principle

J. Allan Cash

—the last word in public road transport, a Soviet-made electric trolley-bus, the product of the Stalin Automobile works

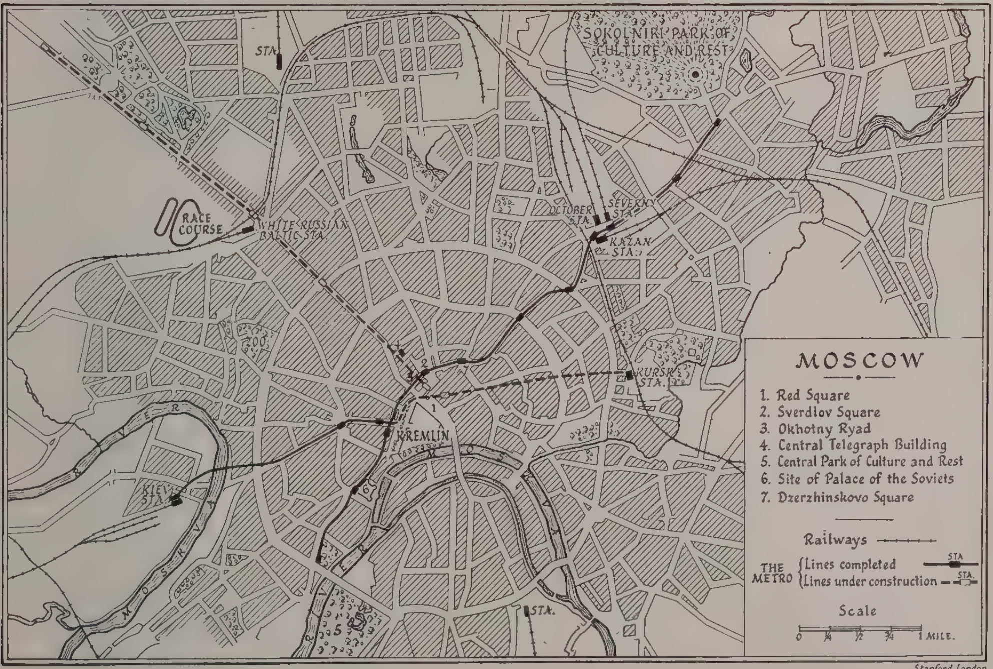


The new Moscow Metro, which owes something to English advice, is an example of the conscious union of art and industry, as well as of communal effort. Many thousands of citizens did voluntary work in their spare time on its building, and the people of Moscow regard it with pride as their common achievement. The individuality of the stations is expressed in each case by a particular scheme of decoration, to which the free use of varied types of marble contributes a palatial air of the radial-circular city. Architects of 'left' tendencies, under the influence of Le Corbusier, desired completely to do away with existing Moscow and to plan everything anew, substituting for the circular zones a system of parallel ribbons (industrial zone, residential zone, administrative zone). Their plan was discarded, as was also the conservative plan which strove to preserve Moscow as inviolable—a museum city, with all its crooked streets, ugly detached houses—while building new quarters outside the town. The plan for the reconstruction of Moscow also discards the policy of splitting up the city into smaller units, into a conglomeration of satellite towns, as well as gigantomania—the building of sky-scrapers. There is no abstract schematicism in the plan. It is not ideal or Utopian, but a practical programme of work.

The plan fixes the territory of the future Moscow in accordance with the numerical size of the future population. The territory will be doubled when the population has increased by 40 per cent; the density of population in the old residential quarters will be reduced to 600 per hectare (at present it is 1000), and in the new residential quarters the density of population will be only 200 per hectare.

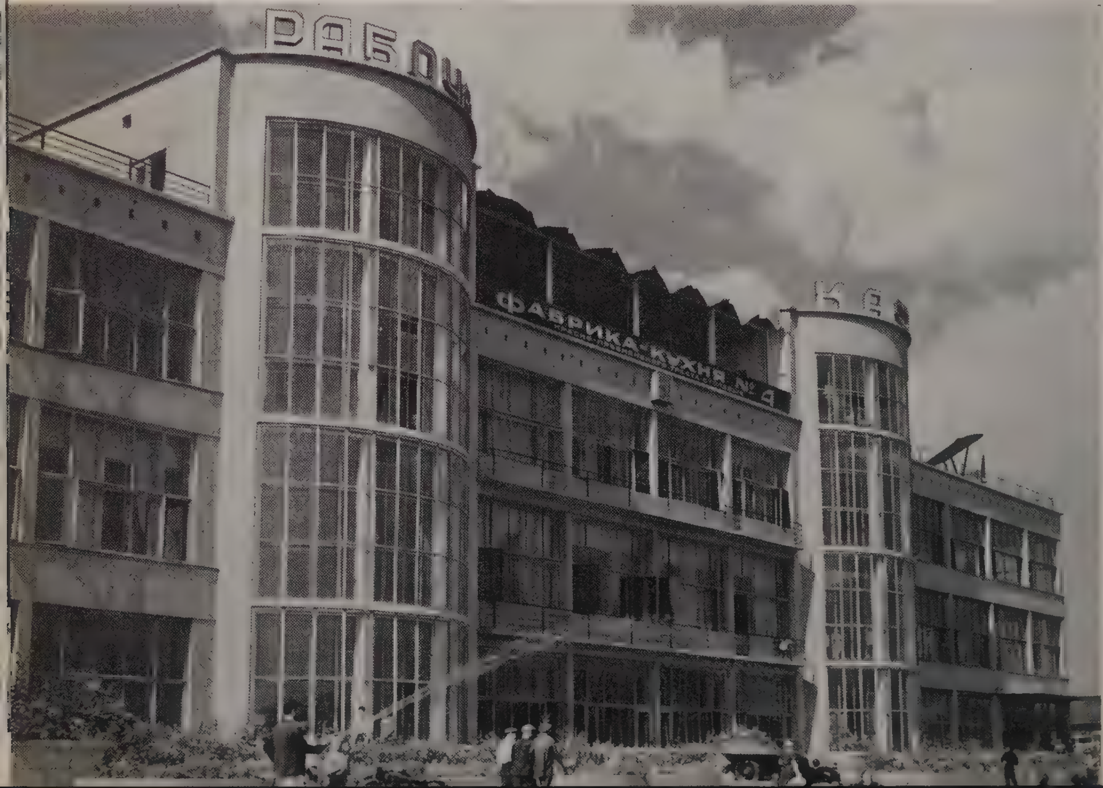
FIGURES RELATING TO THE RECONSTRUCTION OF MOSCOW

	1935	1945
Population . .	3,600,000	5,000,000
Territory of the town (in hectares) . .	28,500	60,000
Housing area (in square metres) .	15,000,000	30,000,000
Water supply (in buckets) . .	56,000,000	180,000,000
Capacity of heating stations (in kilowatts)	89,000	675,000
Area of surfaced streets (in square metres) .	3,000,000	10,000,000
Length of tramway lines (in kilometres) .	450	800
Number of omnibuses	450	1,500
Number of trolley buses . . .	50	1,000
Number of taxis .	500	2,500



Stanford, London.

According to a recent observer (Sir E. D. Simon, Moscow in the Making), *'the overcrowding in Moscow is appalling': population has far outstripped accommodation. Nevertheless, great efforts are made to house the more important specialist workers adequately.* (Above) *engineers' flats;* (below) *a communal café supplying meals for factory workers*



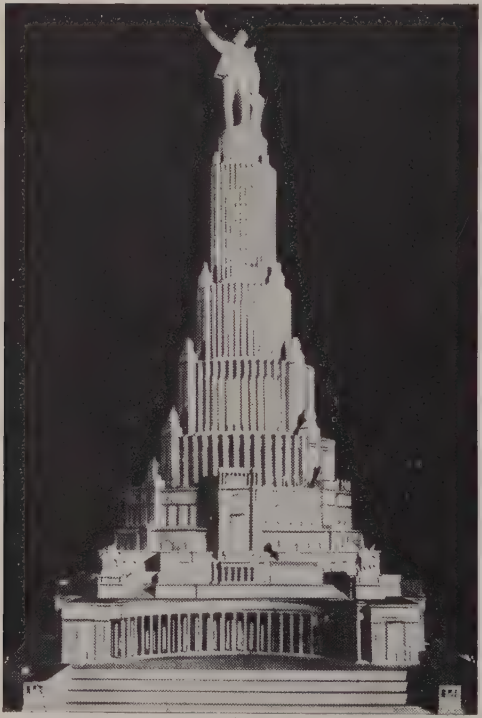
J. Allan Cash

The élite of Moscow—an aristocracy of function from whom more is expected than from the people at large—are correspondingly favoured. These holders of responsible and leading positions meet their acquaintance at social centres like the 'Red Poppy' café, near the Kremlin and the Red Square

The settled parts of new Moscow will cover an area of 40,000 hectares, as against the present 24,500 hectares, and will be divided in the following way:

	Hectares	%
Industry (basic and municipal)	4,600	11·5
Railway transport . . .	2,200	5·5
Residential quarters . .	9,550	23·9
Public buildings . . .	5,350	13·4
Streets and squares . .	6,000	15·0
Green open spaces . .	9,700	24·2
Water expanses . . .	2,600	6·5
TOTAL . . .	40,000	100·0

To facilitate traffic, the principal Moscow streets will be straightened and made twice their present width—up to 40 metres—while three new roads will be made running parallel with the more congested main arteries. For the relief of the centre and radial streets, traffic is being diverted to the circular routes; in addition a new traffic ring is being built through the parks, and the city will be intersected by new main thoroughfares, linking up the outer districts while avoiding the centre. These will be 60 metres wide in places. The Lenin Prospect—from the centre of the town to its south-western boundary—will be 120 metres wide. (The Mall in London is 48 metres wide and the Champs Élysées 90 metres.) New squares are to be made. The width of the Red Square will be doubled.



Planet News

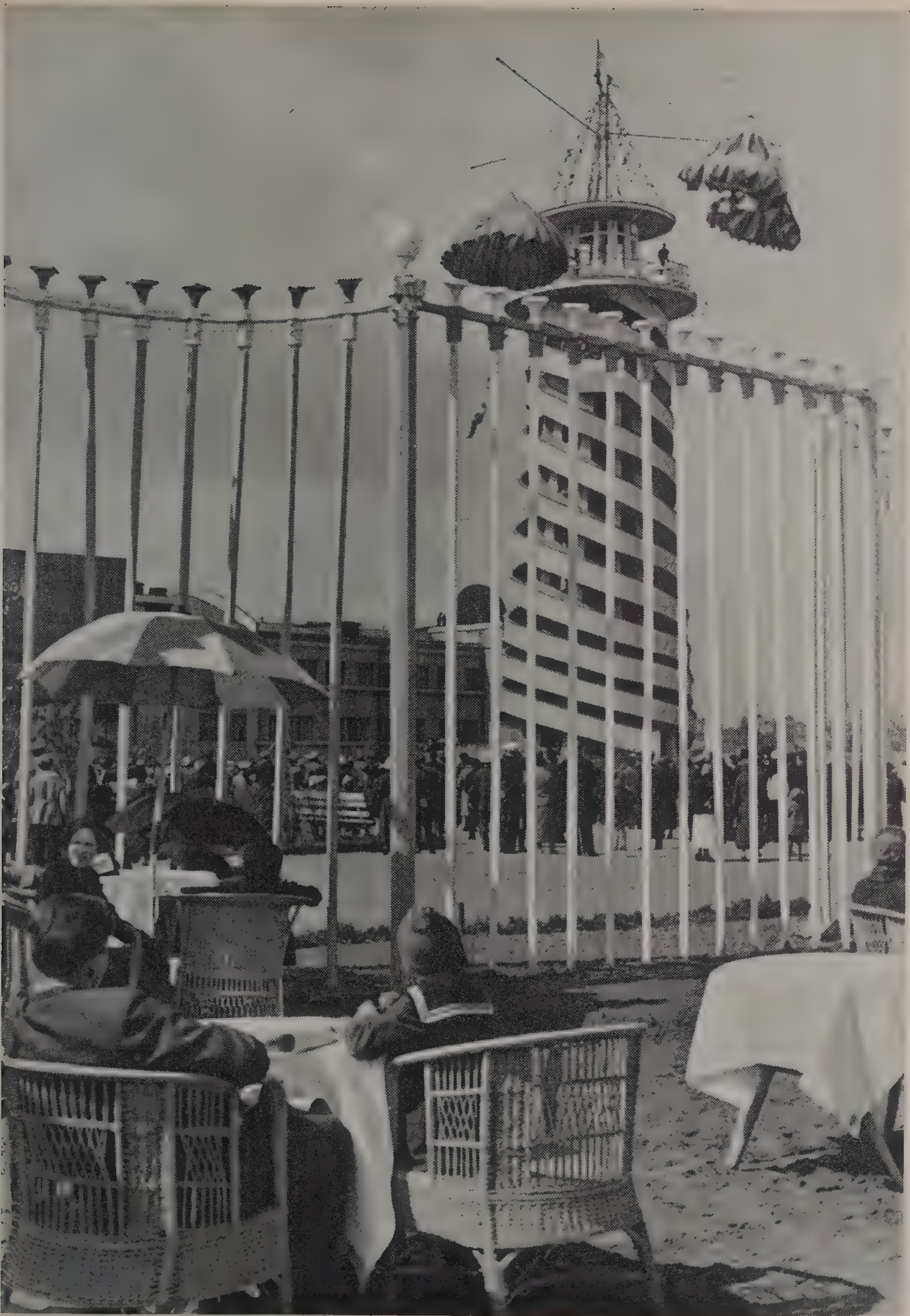
A design for the Palace of the Soviets: 1350 feet high, surmounted by a 260-foot statue of Lenin, with foundations covering 24 acres

Moscow will be beautified by big new buildings. The biggest of them will be the Palace of Soviets, which will have a hall with seating accommodation for 20,000: the height of this building will be nearly 1350 feet. In putting up the new buildings regard will be had not only to the form of each individual structure, but to the entire form, a system of ensembles being created which will link up into one whole the big squares, prospects and embankments.

Even now the principal streets of Moscow have their 'art directors' among whom may be counted academician architects. They approve the style, form and colour of every house and even every sign put out in a street, so that each detail may be in keeping with the general plan.

Soviet architects are accustomed to deal not so much with small work as with complex architectural ensembles. And they can work accordingly because they are not designing for individual clients and have no compulsion to study the owner's taste and idiosyncrasies regardless of the surroundings. They can give full scope to their imagination without the irritating considerations of property boundaries.

The plan for the reconstruction of Moscow opens up prospects of creative work for the builder, architect and sculptor. The principal aim of the plan is the consideration of the human being, the



Planet News

Prominent in the Central Park of Culture and Rest is a tower for parachute-jumping practice

J. Allan Cash

For the body, Moscow provides the training that, after many undress rehearsals, culminates in the great annual festival of gymnastic culture

J. Allan Cash

For the mind, there is every provision within the canons of Communism, from the public newspaper stand to the Lenin Library with its 6,000,000 volumes

J. Allan Cash

The women of Moscow labour according to their several abilities for its greater glory: some reinforcing the banks of the Moskva River, now augmented by the waters of the Volga—

John Burton

—others supporting, at the Art Theatre, Moscow's claim to be 'the theatrical centre of the world'

Kurt Lubinski

A children's bookstall, which amusingly illustrates the Russian taste for placard art. In no city are educational opportunities more equal or widespread

creation of the most comfortable and hygienic conditions for the life of the population in the new capital. A third of the area in each new residential quarter will be devoted to green open spaces. Whereas at present Moscow has 8·5 sq. metres of open space per head, *i.e.* almost as much as London (9·5 sq. metres), after the reconstruction Moscow will have 20 sq. metres of green open space per head of population, and if the parks are included, 50 sq. metres per head.

All the 124 industrial enterprises which are harmful from a sanitary point of view or which present danger from fires will be moved out of the town. The railway depot and sorting station will also be removed beyond the city boundaries. The electrification of all railways and the removal of gas factories from the city to the outskirts will eliminate smoke from the town.

A remarkable feature of new Moscow will be the centralized supply of heating. Even now one of the interesting functions of two huge power stations in Moscow is the heating of practically the whole of the centre of Moscow, including such a building as the Bolshoi Theatre, by water which leaves the station at a temperature of 120 degrees Centigrade, returning at about 60 degrees. The economy resulting from the abolition of separate boilers for each house is quite considerable. The heat energy of fuel is utilized more extensively in comparison with any other European power station. This system has been so successful that in the reconstructed Moscow one-third of the houses will be heated by seven power stations; 675,000 kilowatts will be generated for that purpose in 1945 instead of 90,000 in 1935, and that will satisfy as much as two-thirds of the total heat requirements of the town. At the same time the consumption of fuel will be reduced by a third or, in absolute figures, by 4·5 million tons, as compared with the system of separate heating of each individual house. This will greatly relieve the railway transport system. Coal will be pulverized at a central mill and in this form the fuel will be carried to all power stations by pulver ducts. This will eliminate one of the principal causes of dirt in the city.

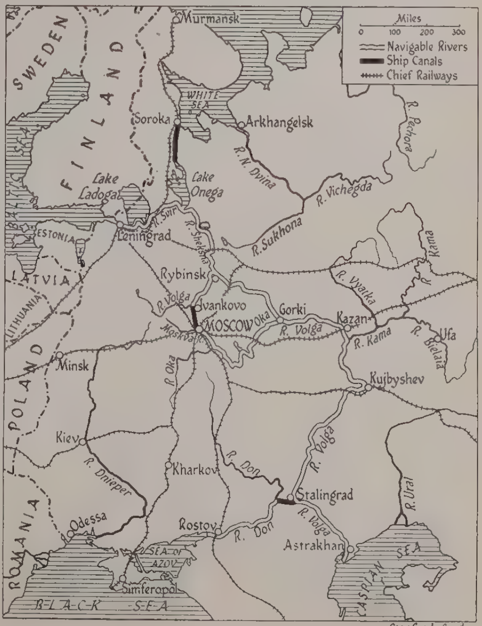
There will be considerable changes in the hydrographical régime of Moscow. The Moskva River gave its name to a great city but until now has been unable to give it sufficient water—in summer-time it moved only about 8 cubic metres per second. Industrial Moscow drank up more than half its river; within five years the growing town would have drunk it to the last drop.

Only shallow-bottomed ships of small draught could pass along the shallow river and reach the town. Timber, oil, building materials went from the Volga to Moscow on wheels, instead of going by the cheap water route. The turnover of goods at the river port of Moscow in the year 1933 reached only 600,000 tons—40 times less than the corresponding figure for the Moscow railway junction. (Figures for Berlin are 9 million tons, for Paris 15 millions, not to speak of the seaport of London.)

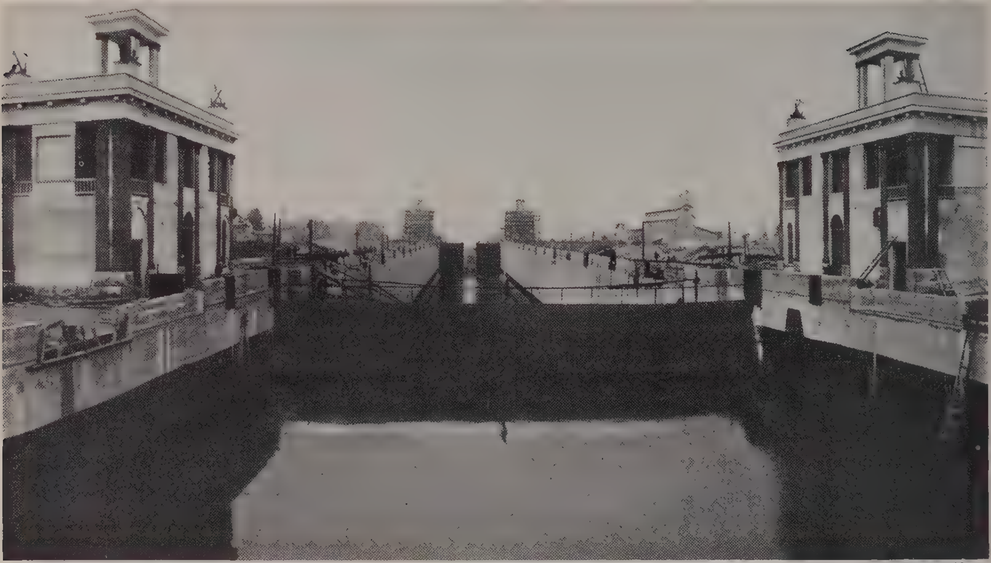
Until this year it would have been difficult for Muscovites to increase the existing consumption per head of water—168 litres per day. But the geographical inconvenience has been overcome by the construction of a canal from Moscow to the Volga, the biggest European river. This canal was officially opened in July; it will supply water for the population and for industrial needs, as well as create a cheap waterway for shipping. The consumption of water per head of population in Moscow is estimated to reach 500 litres per day.

At the village of Ivankovo on the Volga a new dam raises the level of water to 124 metres above sea-level, and turns the river southwards to Moscow. From this level, by the aid of five pumping stations and five locks, the water is raised to 162 metres. The canal now runs from Iksha to Khimki (52 kilometres) and thence, by means of two locks, it descends to the Moskva River. Then through the River Oka the water of the Volga returns to its former bed near the town of Gorki. This artificial river is 128 kilometres long, 5·5 metres deep, 46 metres wide at the bottom and 85·5 metres wide at the top.

The extent of excavation work is seven times greater than in the case of the White Sea Canal, greater than that of the Suez Canal, and only a little less than the excavation work carried out on the Panama Canal. But it took twelve years to build the Panama Canal, while the Moscow-Volga Canal has been completed in less than five



Stanford, London



Planet News

With the opening for traffic of the Moscow-Volga Canal this summer, Moscow became a port accessible to large vessels, and its water supply, hitherto deficient, was assured. One of the locks, which can accommodate vessels up to a length of 613 feet

years. Of the total volume of earthwork of 136 million cubic metres, 96 million cubic metres were excavation work and 40 million cubic metres filling-in work.

With the building of the canal the Moskva River becomes an important artery of transport. For the passage of Volga steamships the bridges are raised 8 metres above the new level of the water. Cargo traffic, however, is not taken along the central channel through the town but diverted to the canals of Andreyevski and Setunski, which is more direct than the tortuous, winding Moskva River.

Hitherto the Moskva River has been dirty and shallow, but now that its bed has been filled with the water from the Volga, it flows at the rate of 45 cubic metres per second instead of 8 cubic metres per second as before. For a distance of 40 kilometres the fine ensemble of the new Moscow buildings will be mirrored in the clear water.

The waters of the Volga pass under the Kremlin walls. A new deep-water port has been created at Khimki, 13 kilometres from Moscow, and the capital of the U.S.S.R. will be connected with five seas—the White Sea, the Baltic, the Caspian, and (after the construction of the Volga-Don Canal) with the Azov and Black Seas. The granite-covered embankments of the Moskva River are to be made into a fine new road 50 metres wide.

By 1945 Moscow will be unrecognizable, even though its geographical co-ordinates will be the same. The new Moscow will be transformed into a city of a genuine, joyous Socialist life, a city of sunshine and big open spaces, a city of green trees and water expanses, a city which will fully reflect the greatness and beauty of the Socialist epoch.

Mambau

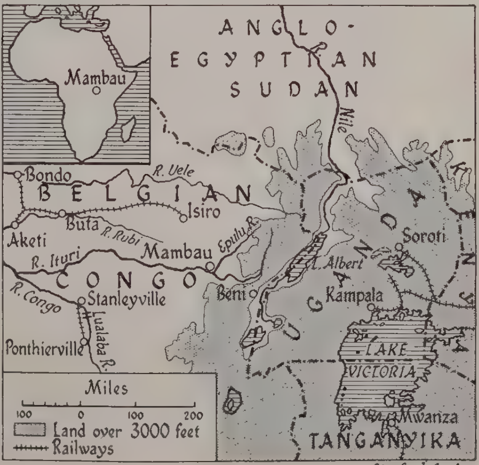
An African Experiment

by MARTIN BIRNBAUM

Although the United States Government controls no territory in Africa, American influence on that continent is considerable, being exercised through commercial companies interested in the exploitation of raw materials—such as rubber in Liberia and copper in Rhodesia—through missionary and scientific institutions, and through the activities of those individual American citizens whom Africa has drawn, by sheer fascination, into her service. That their love may be returned, and their exertions repaid, is shown by the following account of Mr Putnam's remarkable establishment in a remote corner of the Belgian Congo

In 1927, two years after Patrick Lowell Putnam had graduated from Harvard University, he went to Central Africa as an assistant research worker on an anthropological expedition organized by his Alma Mater. With only slight interruptions, he has remained there ever since. From the very first he felt intuitively that the trackless forest was to be the field of his life's endeavours, and he volunteered to work there for the Belgian Red Cross. To make himself more valuable, he took a short medical course in tropical medicine at Brussels, and was eventually appointed 'Agent Sanitaire' in the Belgian Congo. This work offered an opportunity to familiarize himself with the country, its curious primitive negro tribes and some of their native languages. Of all the places he visited, the virgin forest region of the Ituri River basin made the strongest appeal, and in 1932 he began to build a home at an enchanting spot, hidden in the jungle, and yet only a few kilometres from the main road between Beni and Stanleyville. It is on the bank of the Epulu River, on a plateau traversed by countless other streams, all eventually emptying into the Congo River. Not far away—as African distances go—are the ruins of Fort Bodo, Stanley's headquarters, which he left to go in search of Major Bartelot, who was massacred by the slave traders with whose inhuman activities he tried to interfere.

Unlike the negro tribes of the province, who would have burnt a clearing in the jungle for their village and their manioc or banana patches, Putnam avoided, as far as possible, destroying the forest giants or even the smaller trees, and for this reason the natives named his settlement Mambau—in honour of the white man who lives, like the pygmies, without cutting down trees. Here, the Epulu River breaks into rapids and whirlpools among the rocky islets which cut its breadth into swift channels. Brooks murmur engagingly as they rush and tumble over mossy rocks to join the larger stream. Orchids gleam in the forest recesses, and huge macrolobium trees—their branches weighted down with luxuriant creepers—reach majestic heights, towering over the almost impassable woods beneath. In 1933, a year after Putnam



Stanford, London

All photographs by Martin Birnbaum

On the banks of the Epulu River, in the heart of the Congo forest, the most primitive and civilized elements are harmoniously blended in the settlement founded by Mr Putnam in 1932

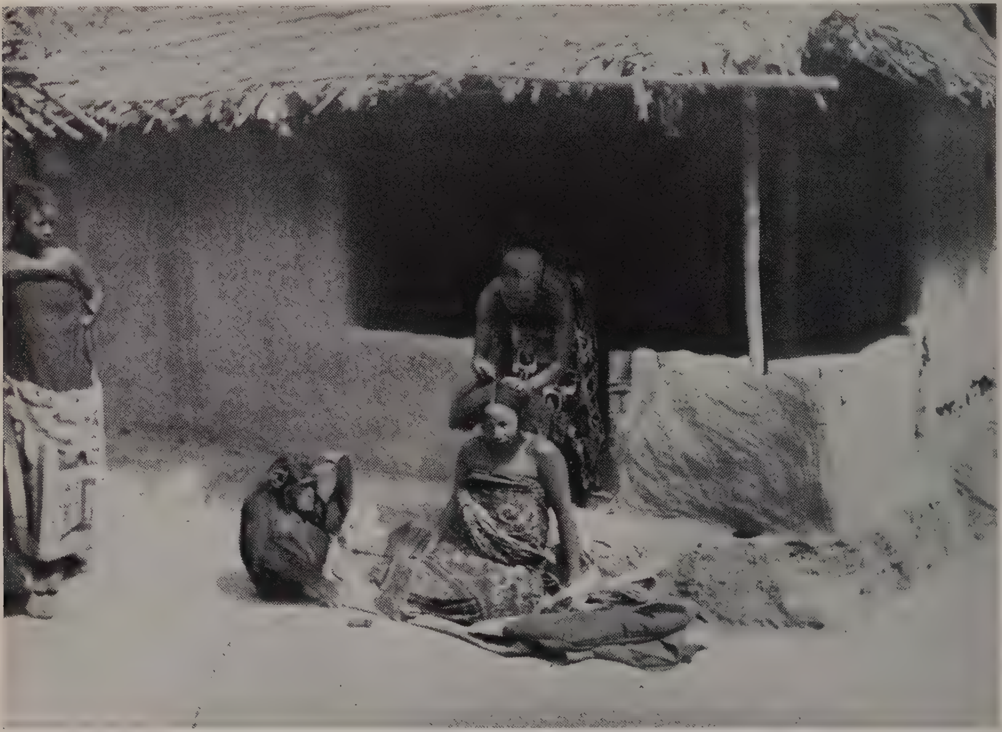
started the settlement, King Leopold and his lamented Queen Astrid visited the spot to see something of the famous pygmy tribes in this section of their vast colonial domains, and, ever since, Putnam's Camp has had a long list of distinguished visitors who come to hunt or to study.

Putnam left for America to marry a girl who is as fond of the jungle as he is, and soon after their return they began to build in earnest. Their original thatched house, with its two rooms and bath, was built under an immense macrolobium, close to the cataract of a brook in which the pygmies bathe, and which is used by the negroes of Mambau for their laundry work. When visitors began to arrive, it became a guest house, a stone's throw from the new main building, the feature of which is a rectangular living-room of excellent proportions, in the middle of which is a raised brick platform. On it, logs are always flaming or smouldering. The smoke rises to the high roof, thickly thatched with phrynium leaves like a pygmy's hut, and escapes as it can among the interstices, after turning the dry leaves a warm brown. Comfortable armchairs surround the open fire, and antelope skins or beautifully designed fibre mats take the place of rugs. Dance masks, bows and arrows, shields, tapa cloth, *egbes* (the fascinating 'bustles' of the Mangbettu women) and platters, woven of coloured raffia fibres, serve as harmonious wall decorations. Vases filled with overwhelmingly fragrant frangipani blossoms, or the flaming hibiscus, are evidences of Mrs Putnam's taste. Bookshelves, against every available bit of wall space, are filled with a good collection of Africana, and the great window looks out upon the swirling waters of

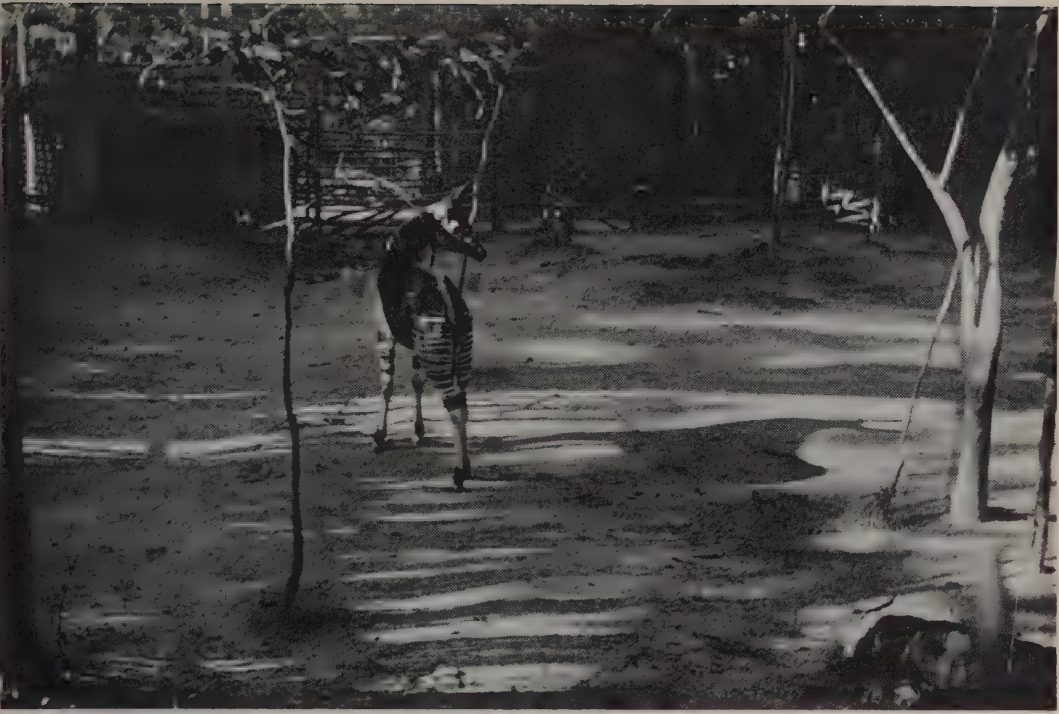
Here the pursuit of African studies amid the surrounding forest—in the preservation of which Mr Putnam has set an example—is aided by a comfortable house and a well-stocked library

Mr and Mrs Putnam with two of their pet chimpanzees, 'Angelo' and 'Mister Fataki' the Epulu. On its banks you will find shady coves for bathing, and native pirogues which invite the skilful canoeist to paddle toward the wooded isles which break the stream into rather perilous channels. At right angles to the living-room, and next to the kitchen, is an open-air dining-room, ruled over by Mrs Putnam and her staff of able 'boys', who create not only European dishes, but succulent African culinary surprises as well. Dwarf antelopes are usually served after a hunt. Lizards, in place of frogs' legs, may be hesitatingly tried. Young shoots of the elephant's ear plant have been found to be an excellent substitute for spinach. Putnam himself is fond of toasted termites, and there are always fragrant mushrooms and wild honey brought in by the pygmies. From the main living-room, doors lead to the baths and guest rooms, which are simply furnished but with a taste unfortunately still rare in the Congo.

Perhaps even more surprising to the newly arrived visitor than such a restful, comfortable forest abode is the miniature zoological garden which surrounds it. You are welcomed by whistling grey parrots, from the orange tail feathers of which the Mangbettu chiefs make their distinctive pompons. Savage baboons and gentler proboscis-monkeys (*Cercopithecus*) and colobus monkeys, chatter and pull at their chains. Dwarf antelopes (*Cephalophus*) in ample enclosures may overcome their shyness to nibble salad from your hand. In a deep trench a strange reddish-yellow water-hog with tufted ears wallows in its muddy pool. Dangerous horned vipers, which fortunately travel

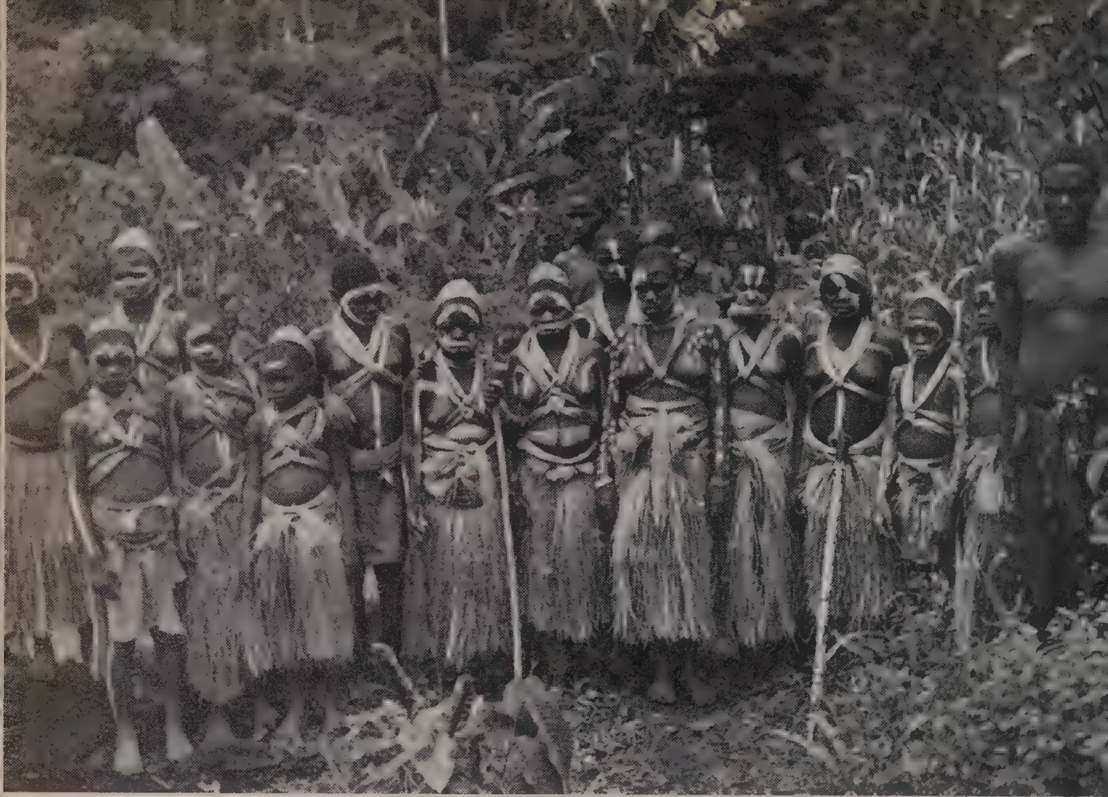


Mr Putnam's establishment provides work for a considerable negro population, and 'Mister Fataki' has learnt to imitate many of their habits. He is here seen following the motions of a native hairdresser

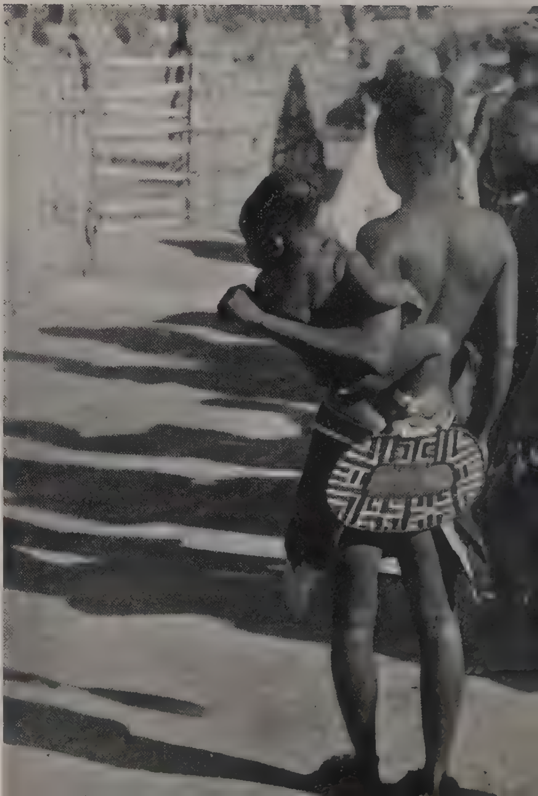


The Mambau Zoo has held several specimens of that rare animal, the okapi (above), *peculiar to the dense forests of the Congo. Another inmate* (right) *is a red water-hog with tufted ears*

The work of building the zoo was done by negroes; but it is the pygmies, with their unequalled skill in the chase, who have assembled the wild creatures of the forest in its enclosures



Among the negro communities which are to be found near Mambau are the Babiri tribes who—as in the case of these young boys and girls—paint themselves with earth pigments for their initiation rites

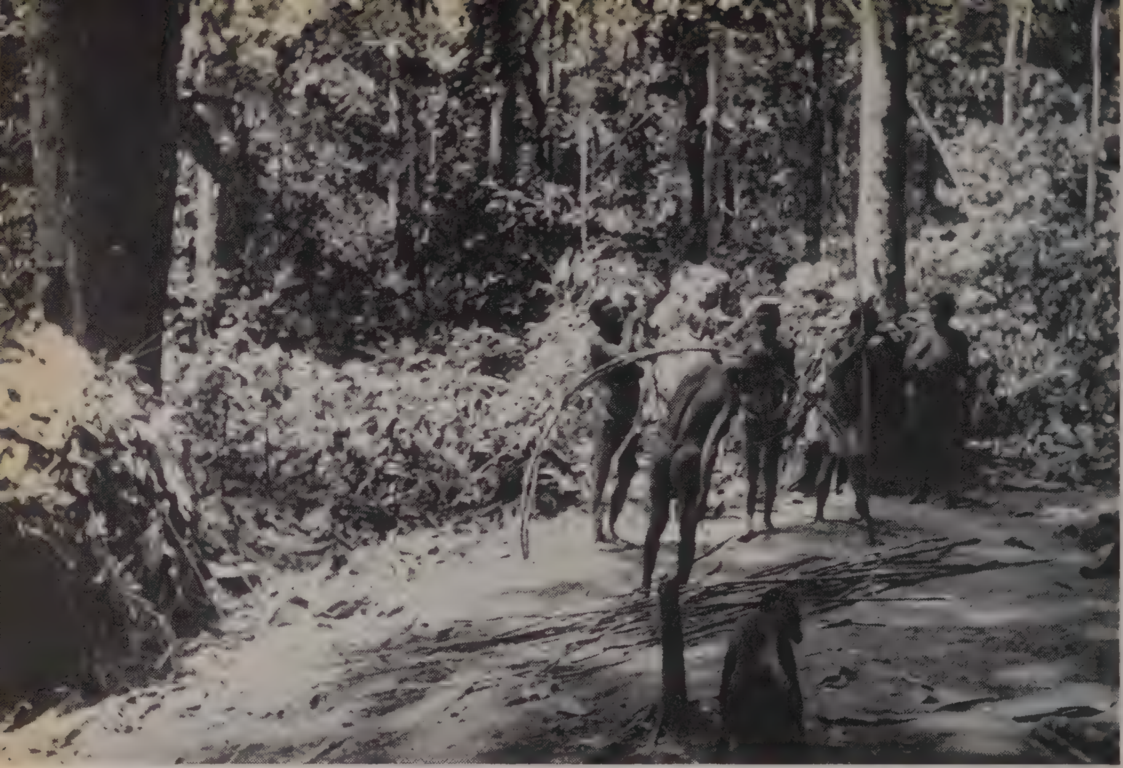


The egbe *or sitting pad is a peculiarity of the Mangbettu, noticeable for their artificially elongated skulls. These fundamental articles of feminine attire are woven of banana leaves, and each village has developed a distinctive style of decoration* slowly, like monstrous caterpillars, are given exercise, while their mortal enemy, 'Aloysius', a tame mongoose, is kept at a safe distance. Of the queer pangolin only the scaled pelts are kept as trophies, with leopard skins and horns of antelope and wild buffalo. They are also planning to acquire a useful elephant from the famous training school for African elephants at Gangala Na Bodio, to do heavy work for the negro population which has gathered together at Mambau to provide safari for the hunters who come to the camp from all quarters of the world. Even after the elephant's arrival, however, the enclosure of greatest interest will still be the one where Putnam holds as captives the rarely seen okapis—those curious links between the zebra and the giraffe, discovered by Sir Harry Johnston as recently as 1901.

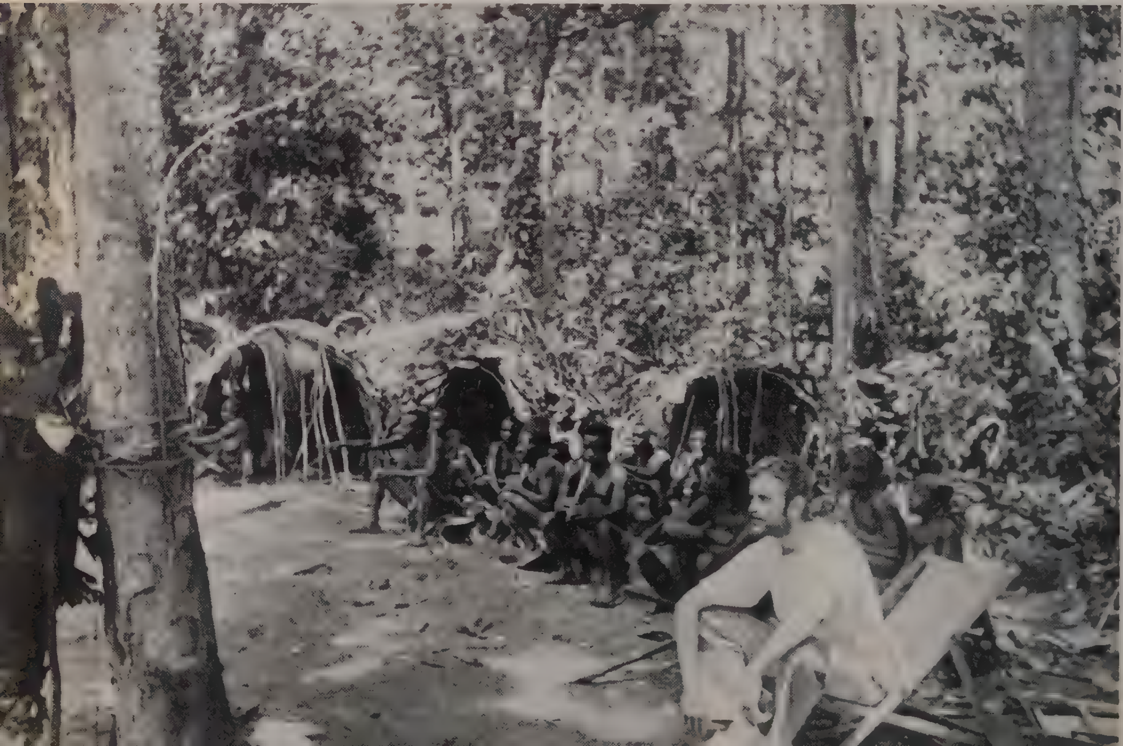
We had already seen four of these animals—all males—at Buta, in the menagerie of the Mission in charge of Brother Joseph, who is an enthusiastic zoologist. A few days before our arrival at Mambau, Brother Joseph had taken away two of the three females to Buta, where an attempt will be made to raise the animals in captivity. The Belgian Government owns and disposes of all these animals, and Putnam merely has permission to guard those which the pygmies capture alive in their cleverly hidden trenches. The okapi is not as rare as at first supposed, for its striped hide is frequently seen in the form of belts and mats among the tribes in the Ituri forest. The adult living specimens we saw were all badly scratched and wounded by the strong nets and ropes which had bound them—for the okapi is a fearless animal, always difficult to handle. The captured specimens will charge all intruders except the negro keepers who feed them, and their well-directed kick may well prove fatal. Putnam had the temerity to enter the enclosure and had great difficulty in escaping the dangerous hoofs, but he told us that young specimens often became quite affectionate and licked his hands with their long prehensile tongues.

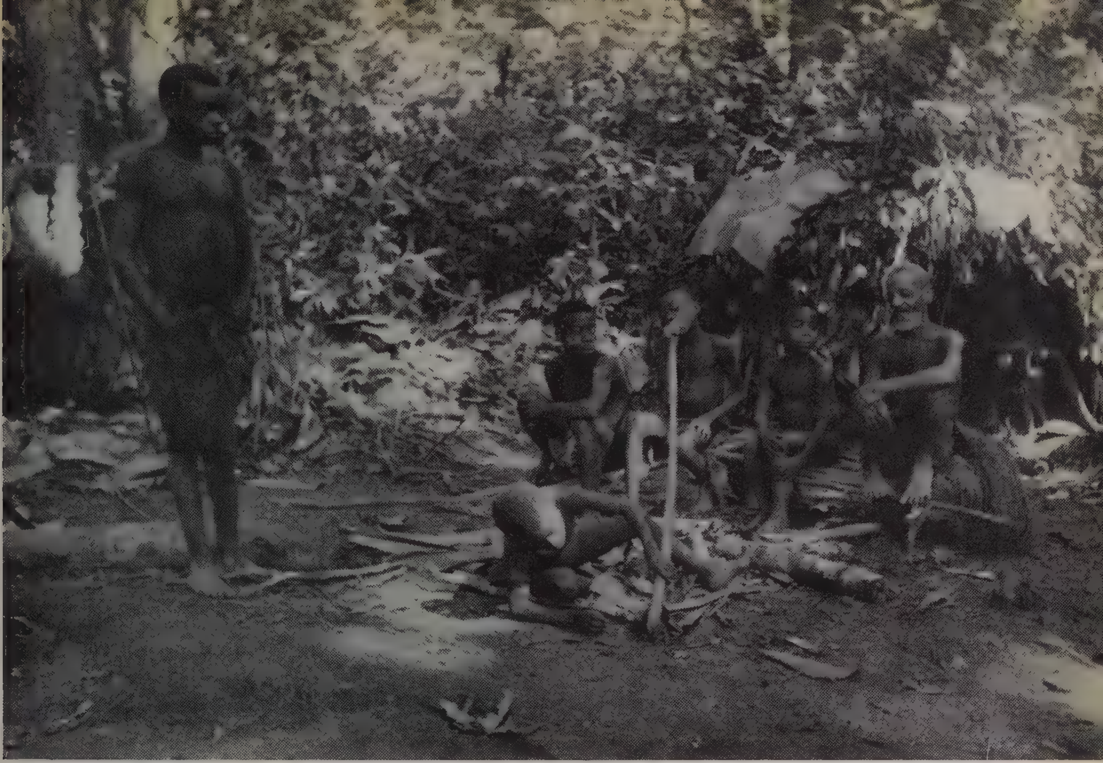
If the okapis are the rarest, the chimpanzees are certainly the most popular residents around Putnam's camp. An entire book might be written about these intelligent anthropoid apes, two male specimens of which are now the entertaining pets at Mambau. 'Angelo' is a helpless baby, who still relies on his she-goat foster mother for milk, but 'Mister Fataki' is over three years old, lives in the open and is giving evidence not only of extraordinary human wisdom but also of tremendous strength. He is mourning the recent loss of a female playmate, but a visit from his master, to whom he is devoted, soon puts him into good humour. In Putnam's absence he is too mischievous to be allowed at large, so he is tied to a tree with a generously long chain, which permits him to climb and swing from high branches. When his master releases him for a promenade, he coils the chain as a sailor would, and carries it balanced on his head and shoulders. If he has been well-behaved, he is not obliged to walk but is treated to a ride on Putnam's back, and he is happiest if the road leads to the pygmies' huts.

The little black people, who are only slightly over four feet tall, are fond of him, but treat him with wholesome respect, and woe to any 'boy' who dares to climb a tree which Mister Fataki has come to regard as his private domain. Only Putnam himself can save the culprit from being bitten by the jealous ape. He takes part in the camp life of the pygmies in an uncanny way, imitating their actions with an exactitude which forces you to conclude that the primate is mentally not far removed from these genial diminutive black men. We were distributing honey to the pygmies, pouring it on shining phrynium leaves, with which each individual provided himself. Mister Fataki watched them for a while, went off to secure a similar leaf for himself, took his place in

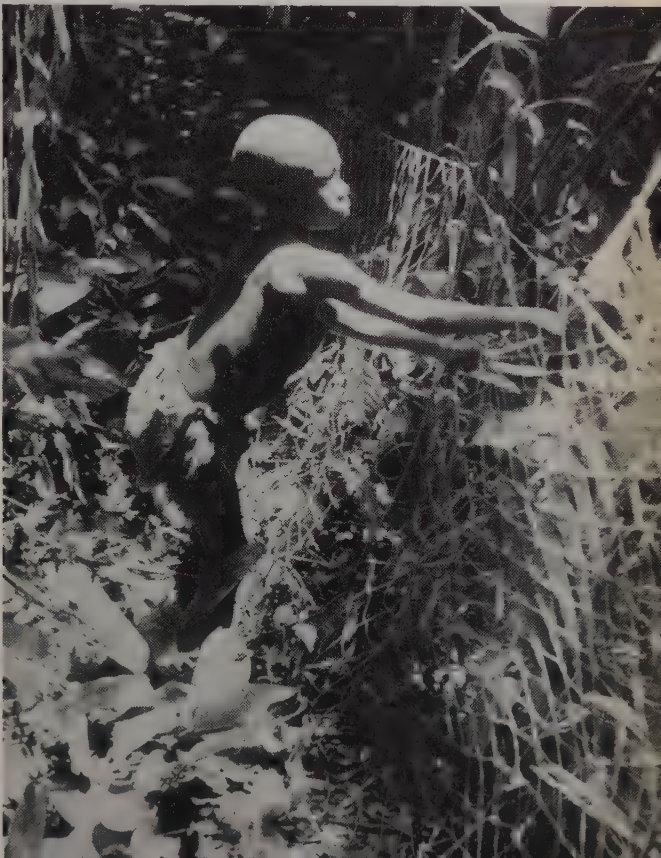


(Above) *House-building: the only manual labour to which the pygmies condescend. Normally each woman builds her house alone, allowing herself a day for the task; but with sufficient help a home can be established in an hour.* (Below) *The local pygmies have attached themselves to Mr Putnam, hunting for him as volunteers*

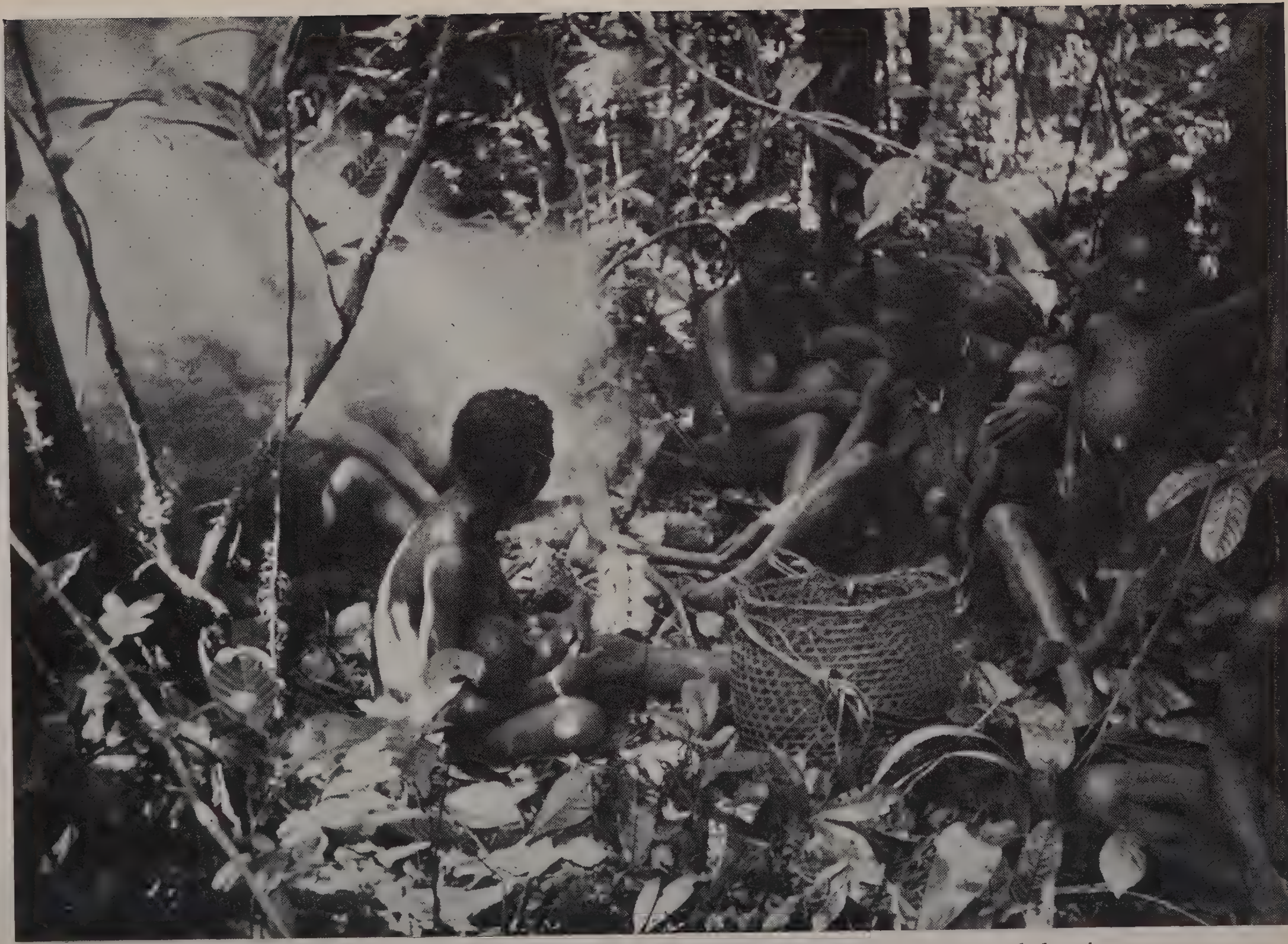




The pygmies are great smokers, obtaining tobacco in exchange for the products of the chase. The communal pipe is made on the spot, of phrynium leaves rolled together. Note the beard of the old man on the right: very rare among the pygmies



Setting a hunting-net. The nets used by the pygmies are made of raffia fibre, and much agility and skill are needed to spread them through the jungle and attach them to each other so that there is no weak place in the cordon



Pygmy women and children, awaiting the return of the men, cook a meal of mushrooms and plantains orderly fashion on the line, and licked up his portion just as the pygmies ahead of him did. After trying in vain to tear a tough protruding root, he was shown how to use a knife, and he then cut the wood as an intelligent child might have done. Provide him with a hammer and pliers, and he will offer to help your chauffeur remove plugs or repair some imaginary motor defect. His human activities are indeed so astounding that it will be interesting to hear of his future mental development and manual dexterity under the guidance and training of his master.

Most people, however, come to Mambau not to see animals but to hunt or capture them, and for that purpose Putnam provides safari to carry equipment, and pygmies to track and aid in the chase. Two communities have grown up around Putnam's camp to supply these needs. In one, you never tire of studying the customs, or the strange tattoo markings and scarifications which disfigure and distinguish the various tribes and rank of the negroes. In the colony or in its neighbourhood there are Mangbettu people with elongated skulls, beautifully tattooed Medje women, Topoké men with cut lips and filed teeth, Babali tribesmen who go through mysterious initiation ceremonies, and many others.

A short walk through the jungle brings you to the pygmy settlement of small hemispherical huts skilfully constructed by their women of intertwined twigs, covered with shining phrynium leaves which shed moisture. Here they await the orders of their *bwana* Patrick Putnam, to whom they have attached themselves in much the same way as they would have done if he had been a negro or Watussi chief. They are not metal workers or farmers, and before the arrival of the white man they were inveterate wandering hunters, who exchanged their game for metal arrowheads, and fruit or vegetables possessed by negro tribes for whom they volunteered to hunt so long as they were fairly treated. Only rarely are they tattooed, with a design borrowed from their former negro employers, and all the men are circumcised. Tempted by the unlimited supplies of salt, tobacco and other luxuries, the restless pygmies are now content to work for the white chief and entertain his guests. They dance for them by moonlight to tamtam music and handclapping, or show how they make their poisoned wooden arrows and their black *tapa* cloth, hammered from the bark of trees. They gather wild honey by smoking the bees out of hives built in the highest trees, or construct their huts before your eyes in an incredibly short space of time. Being remarkably clever actors, they will perform a pantomime showing a tragic elephant hunt in which the enraged, wounded animal turns, charges and kills the hunter. The pygmy known as Sunga, who takes the part of the snorting pachyderm, is an amazing actor. We were told that one of his successful manœuvres while hunting is to imitate perfectly the call of a female elephant and in that way he can separate a bull from his herd.

These primitive little people can, indeed, reproduce the sounds made by most birds and animals with such faithfulness that they deceive the wild denizens of the forest. An even more thrilling exhibition of their histrionic ability was afforded by a short play, telling the story of an attempt at abduction. While the hunters are absent from a village, a stranger attempts to steal one of their women, but an old pygmy attacks the invader. A duel with spears and shields follows. The hue and cry raised by the women brings back the hunters who kill the enemy. A cannibal feast in which the dancing women and children gleefully take part, ends the performance.

The climax of a stay at Mambau is to take part with the pygmies in a real hunt in which all the able-bodied men, women and children join. On such an occasion the tribe is armed with bows, arrows, spears and shields, and with nets made of raffia fibre. As a matter of course, Pembo, Putnam's black dog, who in spite of the fact that he has only three legs is still the leader of all the pack in the village, runs ahead. The large bell hanging from his neck is silenced with vegetable stuffing, although at times it is allowed to ring and announce that Pembo is holding some animal at bay.

Before the actual start a sacred fire is built, and, as each hunter leaves, he warms his net for an instant over the magic flame, for luck. The men separate, the leaders marking the trail by breaking twigs and dropping fresh leaves to guide their followers. If they want to get into touch with one another, they make a cup with the palm of their right hand and with it they beat vigorously another hollow made by their chest and left shoulder. You are assigned to Musa, Mangele, Sunga or some other pygmy whom you are advised to follow closely, but this is no easy task. His muscular, nude frame, four and a half feet high, slides through all forest barriers. He leaps over snags and obstacles, avoiding all the lianas and plant parasites which entangle your clumsy, cumbersome frame. If, bewildered by the playful green shadows, you lose sight of him only for a moment, the terrifying silence of the jungle immediately hems you in, and the wilderness seems full of unseen dangers. You cannot see two yards ahead, and your nerves begin to get the best of you. Surely some animal is stealthily stalking you, and the trailing plants seem to be deadly vipers. Even a shaft of light is a menace, you are in such a state of tension and suspense. There is no respite, however. You must stagger blindly through the wall of luxuriant vegetation and are relieved to discover your pygmy standing like a silent, smiling statue, with his finger on his lips, imploring you with eloquent eyes not to make so much noise.

He then begins spreading his net in the underbrush. Ferns and creepers hide it effectively and he attaches it to the nets of the hunters who precede and follow him. In this way, an unbroken, invisible crescent, made as it were of a great single net, is laid. This having been accomplished, the silence of the jungle is suddenly broken by the screams and halloos of the women and children, who are distributed in a chain, between the extremities of the long segment of the rude circle formed by the nets. Any animal in this enclosure will naturally avoid the shouters, who start closing in, and will run toward the silent hunters, stationed at intervals near the entangling barrier. When an animal is discovered, the character of the deafening yells changes entirely. The smaller rodents escape through the nets, but when a dwarf antelope (*Cephalophus*) is caught in the meshes, one of the alert pygmies leaps over and under the treacherous lianas with the speed of a wild hunted creature, pounces upon the desperate, bleating animal, ties its fore-legs and hind-legs, and brings it in triumph to the bwana, carrying it on his shoulders like a tiny black, good shepherd.

After each catch the pygmies take down the nets and move on to another area. During such intervals they meet and rest in a clearing where the women roast plantains and mushrooms wrapped in aromatic leaves, while the men pass from mouth to mouth a long communal pipe made on the spot out of phrynium leaves. If the white man is not there to supply tobacco, they smoke dried vegetable tissues. When it is all over, and you leave their camp exhilarated and happy, in spite of having been scratched by thorns, covered with mud of the morasses in which you floundered, and drenched to the skin by dew and perspiration after the effort to keep close to your man, they give you such a rousing send-off that you mentally vow to return to Mambau and the hospitable Putnams, to continue your studies and share their wonderful forest life.

Guadalcanal and Malaita

Native Life in the Solomon Islands. II

by H. IAN HOGBIN

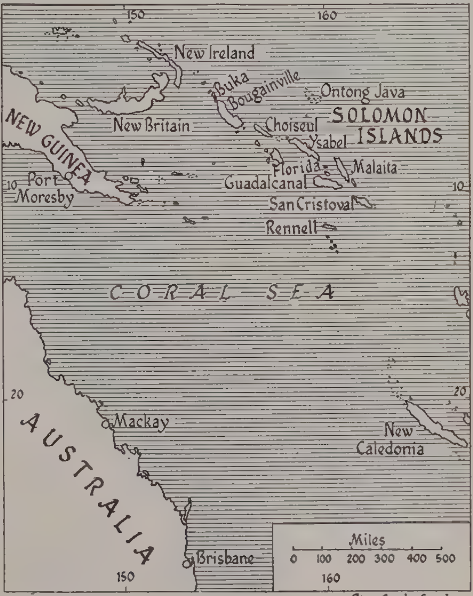
Dr Hogbin, an Australian anthropologist, continues herein the detailed account of life in the Solomon Islands which began in our August issue. Students of the system of Indirect Rule, as applied in certain British territories, will recognize the difficulty of maintaining native leadership where its decline has been intimately connected with the suppression of customs repugnant to the moral ideas of the governing race

In a previous article I wrote of the markets at which the Melanesian people of Malaita and Guadalcanal assemble, whither the 'salt water' people from the coasts bring their catches of fish, the 'bush' people the vegetables—taro, yams, sweet potatoes, maize, bananas and tobacco—which they have grown. These are exchanged, for the salt-water people have no gardens and the bush people do no fishing. Now, mention of markets and exchanges brings us to the subject of currency and objects of value. Strings of shell discs, usually called shell money, are the principal item of currency, but dog and porpoise teeth are in use also. The discs of shell money vary in size somewhat, but they are generally about a quarter of an inch in diameter. Red, white and black discs are strung together on cords from six to nine feet long, which are then bound up into sets of any number up to twelve.

Shell money is manufactured only by the natives who live on the small islands of the Langalanga Lagoon, off the west coast of Malaita. Three kinds of shells are used, the most important being the spondylus, obtained only from certain reefs. The lip of this shell, which alone is used, varies in colour from brick red to raspberry pink. The main source of supply is in south Malaita, and the natives of this area collect the shells and sell them to the Langalanga people.

The work of preparing the shells is done by women only, but the men are responsible for the final rounding off and polishing. The three types of shells have different uses, but in ordinary money red discs predominate, a small number only of black and white ones being put in at regular intervals. The ends of the strings are finished off with black seeds. Each string is today worth five shillings, or rather more if it is a very good specimen.

The Langalanga natives are excellent sailors, and make voyages to most of the eastern Solomon Islands, including Guadalcanal. They buy pigs and vegetables,



Stanford, London

and give shell money in return. It is in this way that the money passes into general circulation. However, in certain districts there are special preferences. Thus in north Malaita the natives will only accept new strings done up into sets of ten, called *tafuli'ae*. These natives consider that old money has lost half its value (thereby revealing that their conception is different from ours), so they are constantly exchanging old *tafuli'ae* for half the number of new ones. On the other hand, in Longgu, Guadalcanal, the natives accept discs of any age, done up into any number of strings up to twelve. They do not reckon that money depreciates with age, and for them a string fifty years old is as valuable as a new one.

The price of goods varies from place to place, but generally speaking ten strings of discs will buy 1000 taro or 500 yams, twenty strings a medium-sized pig and thirty a large one.

MARRIAGE

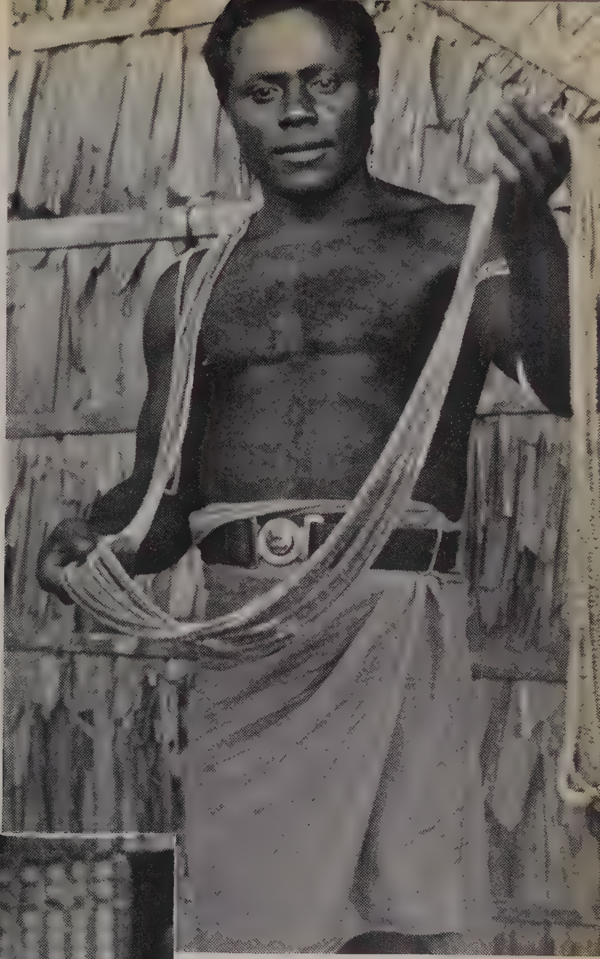
The principal use of shell money is in marriage, when the parents of the bridegroom make presents to the parents of the bride. This has been called purchasing the girl, but such a phrase conveys the impression that she becomes her husband's property to do as he likes with, which is by no means the case. Accordingly it is better to speak of bridal presentations. In the Longgu district the presentation for a young girl is anything from 220 to 500 strings, together with a number of teeth. Thus the equivalent of £60 to £130 changes hands. In addition enormous quantities of food are exchanged and distributed. The food includes pork, vegetables and all kinds of puddings made from yams, taro and coconuts.

One is justified in saying that the Solomon Islanders, in company with many other native peoples, have a cult of food. In spite of the fact that after distribution each family carries home what it has received, all the food at a feast is always publicly displayed in some open place. And from the attention that is paid to it one can readily see that the natives are gratified by the sight. They walk around the heaps of food, comparing the size of the pigs and the quality of the puddings. In great excitement they will say to each other, 'Soon we shall eat till we cannot move', or, 'We shall eat until we vomit'.

In Guadalcanal, since old money has the same value as new, the bridal presentation is not hung up for display. In Malaita it provides a sort of centre-piece for the feast. Here too the amount presented is considerably less, generally not more than 100 strings. This leads to an interesting difference in the ceremony. In both places the bride is led away after the distribution of food, but in Malaita if the bride's people consider that they have not been offered enough they sit in front of the house where she remains during the festivities, so that the bridegroom's mother cannot enter to take her. They continue to sit here, chatting gaily and chewing betel-nut quite unconcernedly, until a further amount of money has been hung up with the rest. Then if they are satisfied they move aside, and her future mother-in-law brings the girl outside. Her father hangs a *tafuli'ae* around her neck as a present to her husband and gives her a lecture on her future duties. Then, naked except for a collection of heavy shell ornaments, she is led away to the settlement where her husband awaits her. In Guadalcanal the marriage is always held in the bridegroom's village.

As may be imagined, marriage is a very important social event. It is no wonder therefore that it captures the imagination of children, and that for weeks afterwards they play at weddings amongst themselves, imitating the behaviour of their elders as closely as possible. Instead of shell money they use chains of red flowers or long streamers cut from a species of nut tree.

Currency in the Solomon Islands takes the form of strings of 'shell money', discs of coloured shell elaborately rounded and polished. Its principal use—barter being the basis of ordinary commerce—is in márriage, when the bridegroom's parents give presents to the bride's



photographs by H. Ian Hogbin

Marriage is an important social event, and the ceremony of handing over the gift of shell money naturally captures the imagination of the children, who play at weddings among themselves. Here the 'bride's father' (left) *is receiving a gift of nut-tree flowers, which rather resemble shell money*

A USEFUL CUSTOM

It can be readily understood that no one individual can ever hope at the time he wishes to marry to have accumulated sufficient wealth for a bridal presentation. He therefore has to depend on his relatives to help him. The parents of the bride also do not keep all that they receive, but distribute a good deal amongst their relatives. Money which has been lent has subsequently to be returned, but this does not impose serious hardship on a man, for he in turn receives a portion of the presentation when any of his sisters or female cousins marry.

At first sight it might appear that the transfer of wealth at marriage is of only spectacular interest. In actual fact it serves several useful functions. In the first place it provides a ready means of disciplining unruly young men, for their elders can always use the threat that unless they reform they will refuse to assist them when they wish to marry. The presentation also helps to stabilize the marriage relationship, for if the bride proves to be lazy or in any way unsuitable her husband has the right to send her home and to demand the return of the major portion of what has been handed over. A girl who has been found unsatisfactory runs the risk of remaining single for life, in which case her parents and relatives are very much at a loss. So an incentive is offered to bring girls up well so that they will make good wives. If the husband is cruel to his bride, then she has the right to return home. Her parents will give back only a small portion of the presentation, so that the husband loses not only his

Some villages specialize in the manufacture of food bowls. For these, and for other objects made only by the inhabitants of certain districts, shell money is the medium of exchange wife but money besides. In addition, his friends, who were willing enough to assist him once, will not be so eager a second time. The fact that so many people are involved in the transaction also tends to prevent the breaking of the marriage bond, for they naturally, being unwilling to part with what they have been given, try to persuade the couple to patch up any grievances. Thus it is clear that 'buying a wife', far from being a harmful or silly custom, is a very useful one. Also, as was pointed out, it presents no bar to marriage, for while money has to be paid out for the men in a family it flows in from the girls. Since the wife is free to return home if she is ill-treated it is clear that she is no chattel.

Divorce is actually extremely rare in both Malaita and Guadalcanal. In the former island husbands are almost without exception inordinately jealous of their wives. Many of them refuse to permit anyone to speak to them.

OTHER USES OF SHELL MONEY

Shell money is used also as a medium of exchange when objects manufactured in one district are required in another. Thus spears made from human shin bone were in olden days fashioned chiefly in one or two villages in Guadalcanal. These were exchanged for ten strings. Today some villages specialize in carving food bowls. The craftsmen make periodic tours with their wares, charging higher prices for them the farther they are carried. Large bowls may fetch upwards of eight strings, but a collection of ten small ones, used as plates, can generally be bought for four strings.

SORCERY

Like many primitive peoples, Solomon Islanders formerly believed, and many still do, that all diseases and deaths are caused by sorcery, not by natural phenomena. We are apt to laugh at the innocent savage for imagining that it is possible to injure a person by the mere recital of a spell, or the performance of some simple rite, but we must not forget that it is not so long since we ourselves indulged in witch-hunts and put suspected persons to death. Also it must be borne in mind that not only sorcerers but also their victims believe in the power of black magic. In the circumstances it is more than probable that often a man, believing himself to be bewitched, becomes ill and eventually dies, though his illness is purely imaginary.

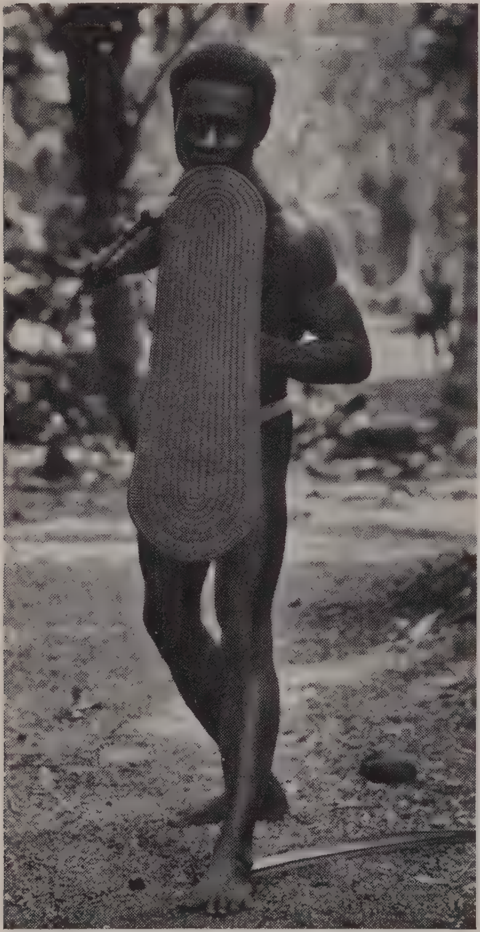
Various types of sorcery were used, the commonest being the recitation of certain charms over the food remains of the victim.

Once a person had died, the object of his relatives was to find out who had bewitched him. In Malaita an inquest was held to find this out by magical means. Hair was cut from the corpse and burnt, and it was believed that a light would thereafter appear on the house of the sorcerer. Probably what happened was that the survivors had made up their minds already who was responsible, and that once this ceremony was performed they sat and waited for confirmation of their suspicions. A firefly or a spark flying over the house would be enough.

The Guadalcanal natives had no method of finding out who exactly had bewitched a person, and consequently, unless they had incontrovertible evidence, the relatives made no attempt to retaliate. Even if the sorcerer was known, they themselves were prevented by mourning taboos from carrying out vengeance. Instead they had to pay a foreign community to do it for them.

FIGHTING

Apart from raids to carry out vengeance, which, as I have said, were far commoner in Malaita than Guadalcanal, regular battles occasionally took place. In Malaita it is said that sometimes over a hundred were killed. The bodies were not infrequently eaten. In Guadalcanal fighting was less bloodthirsty, and the majority of the combatants managed, as a rule, to make their escape unharmed. In the village of Nangali, though no fighting has taken place for thirty years, the war shrine is still tended carefully. Outside hang the skulls and other bones of enemy slain which were brought home as trophies. Most of these bear witness of how the owners met their end.



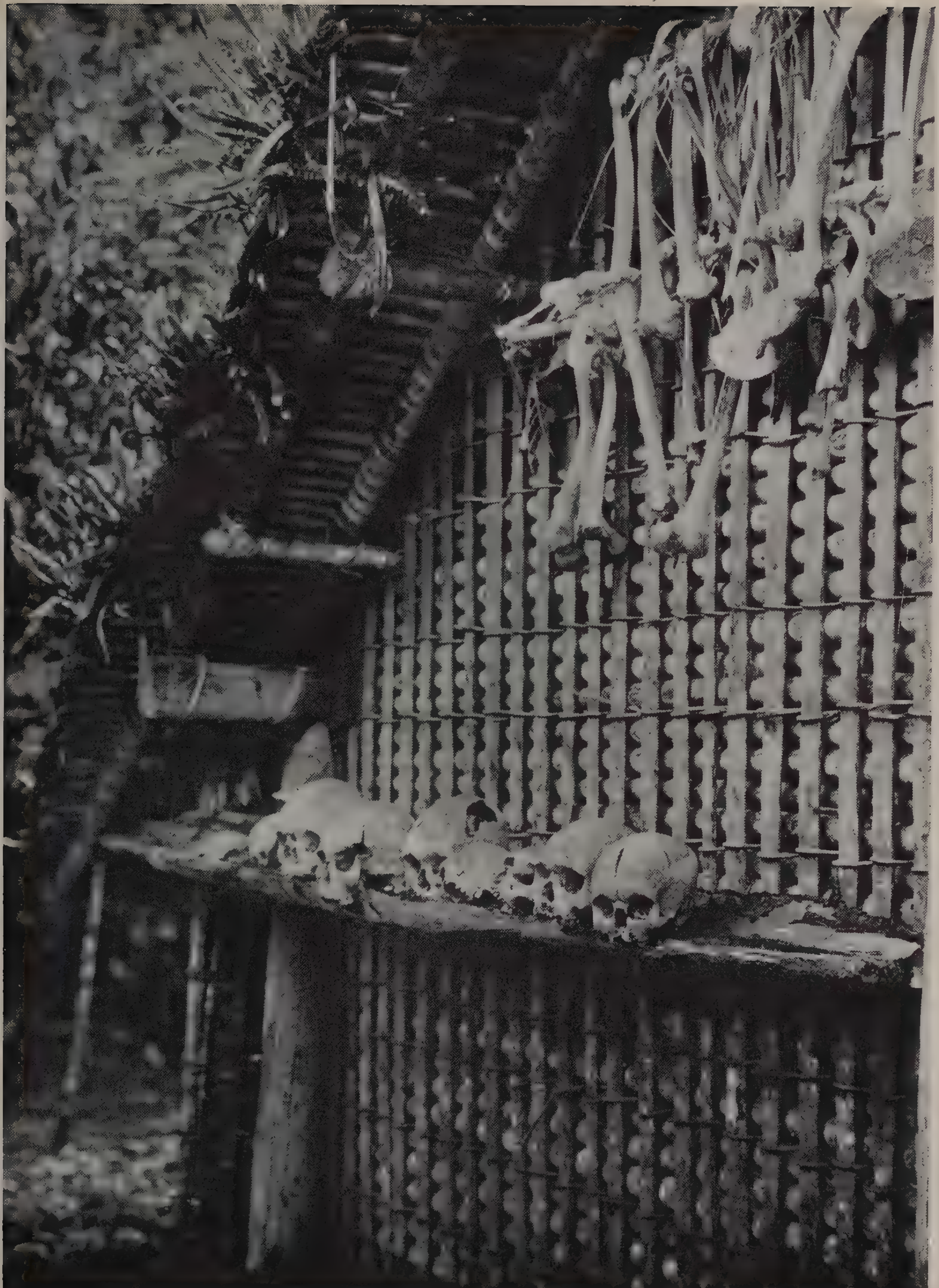
Head-hunting and cannibalism have vanished from the Solomon Islands now, but wicker shields and spear-points of human bone remain as souvenirs—

Although Guadalcanal warriors used clubs, bows and arrows, their main weapon was the spear. The business end was either armed with barbs of fishbone, or else was carved from human shin bone. Small wickerwork shields were also part of the warrior's equipment. In Malaita the favourite weapons were clubs, bows and arrows. The bow, flicked rapidly from side to side, generally served instead of a shield, but in open fighting at times a warrior fought behind a heavy wooden shield carried by another man.

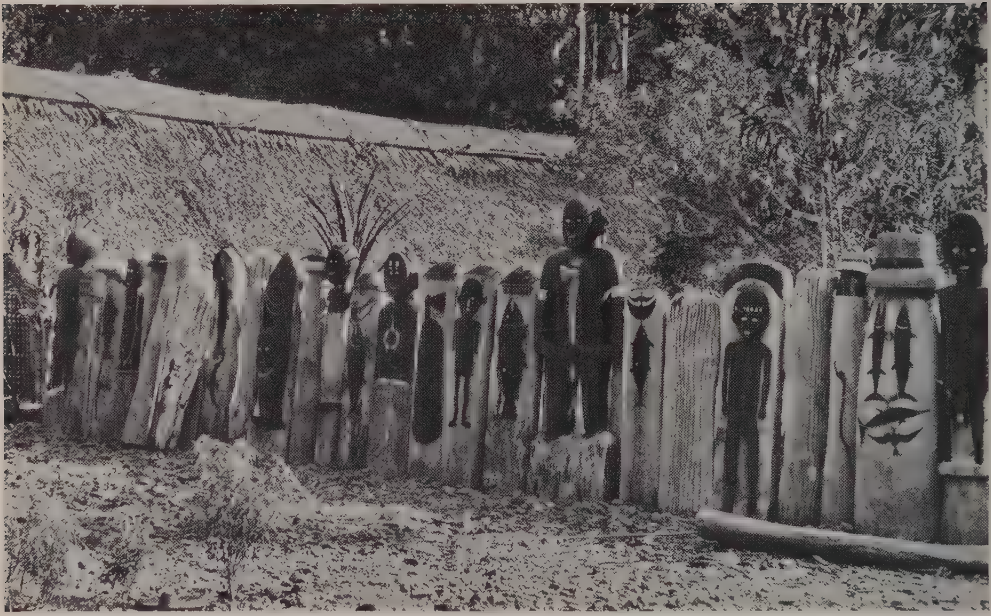
DISPOSAL OF THE DEAD

Practically every possible method of disposing of the dead except mummification is found somewhere in the Solomons. In the hill country of Guadalcanal cremation is customary, while near the coast inhumation is preferred, though often the corpse is weighted and cast into the sea. In Malaita cremation is practised in some districts and inhumation in others. Elsewhere the body is cast adrift in a canoe or exposed on a stone or wooden platform.

After death, although the time that elapses before final disposal varies greatly, there is always a wailing ceremony. Relatives and friends come from far and near to pay their last respects. In Guadalcanal the family of the dead man presents them with a few porpoise teeth for their pains. The mourners are not usually expected to mutilate themselves, though in one island, Rennell, I have seen them hacking their bodies with knives until the blood flowed in streams. Much of the property of the deceased is in some places destroyed, and always his pigs are killed to provide food for the visitors. After some time the body is taken and disposed of in the customary manner. In north Malaita it is bound up with the knees under the chin and buried on its side in a sacred grove. In Longgu it is either buried in a shallow grave with the head only a few inches from the surface, or else it is carried away from the village and covered over with an air-tight



—though not so grim as the ancient trophies which adorn the war-shrine, still carefully tended



The skulls of members of the family (as well as those of enemies) are preserved in repositories, sometimes surrounded by palisades carved with the figures of famous ancestors, bonito fish, etc.

canopy of mats. After the flesh has decayed, the skull is removed and placed in the skull repository of the family, a structure resembling a miniature house on stilts. In Nangali one of these repositories has a palisade around it, each panel of which is carved to represent one of the more famous ancestors. These carvings, crude as they are, are by no means lacking in dignity. In olden days the Nangali villagers buried their dead in the house with a bamboo leading to the head. Water was poured down this continually to hasten the process of decomposition.

RELIGIOUS BELIEFS

The natives believe that the dead have a dual soul. One of these goes to the land of the dead, generally placed either on a mountain-top or in a remote island, and the other remains around the cemetery or skull repository. The survivors carry out religious ceremonies to secure the goodwill of this latter spirit so that their affairs will prosper. Pigs are sacrificed to it, and it is asked in return to make the crops grow well, the pigs increase, and trading affairs bring profits. It is also asked for health and urged to bring confusion to enemies so that their evil designs will be frustrated. This does not mean that the natives believe that prayer is an excuse for not doing their best at all times. On the contrary, they think that the spirits favour those who work hard. But hard work alone, without the goodwill of the spirits, is not enough.

Apart from the dead there are other spirits to be worshipped too. In Guadalcanal sacrifices are also made to shark and snake spirits. The former gives protection on the sea, especially on long voyages, which are fraught with danger for small canoes. Snake spirits are concerned with crops and the punishment of garden thieves. A man who is under the protection of a snake spirit will be certain that, if he loses any of his yams, a snake will pursue the culprit until he confesses his fault. In Malaita spirits which can at will become incarnate as eagles are worshipped and begged to grant fleetness of foot and skill in war. It should be emphasized that the natives do not worship sharks, snakes and eagles as such, but only spirits connected with some members of each species.

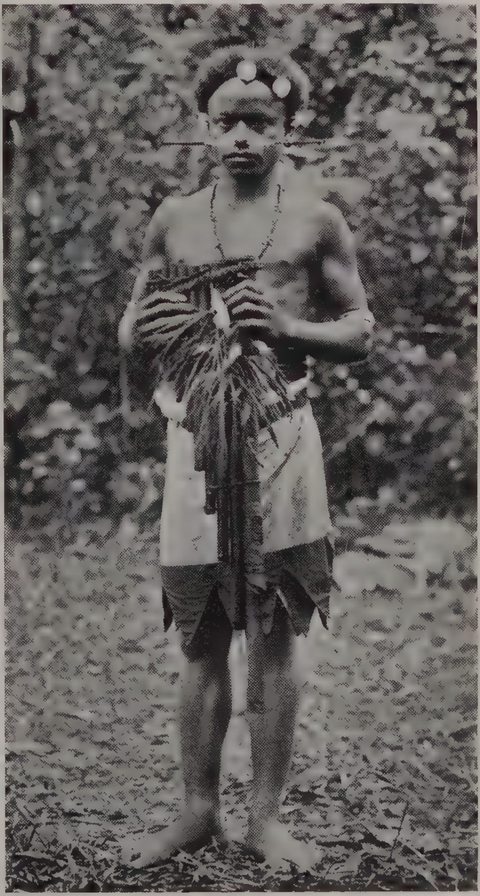
DANCING

In Malaita, in addition to making sacrifices to the beings of the other world, the natives also hold dances in their honour. Readers may recall how in the mediaeval tale of Our Lady's Tumbler a juggler found favour in the eyes of the Blessed Virgin by dancing before her statue. Dancing is still a part of the ritual of the Church in Seville in Spain.

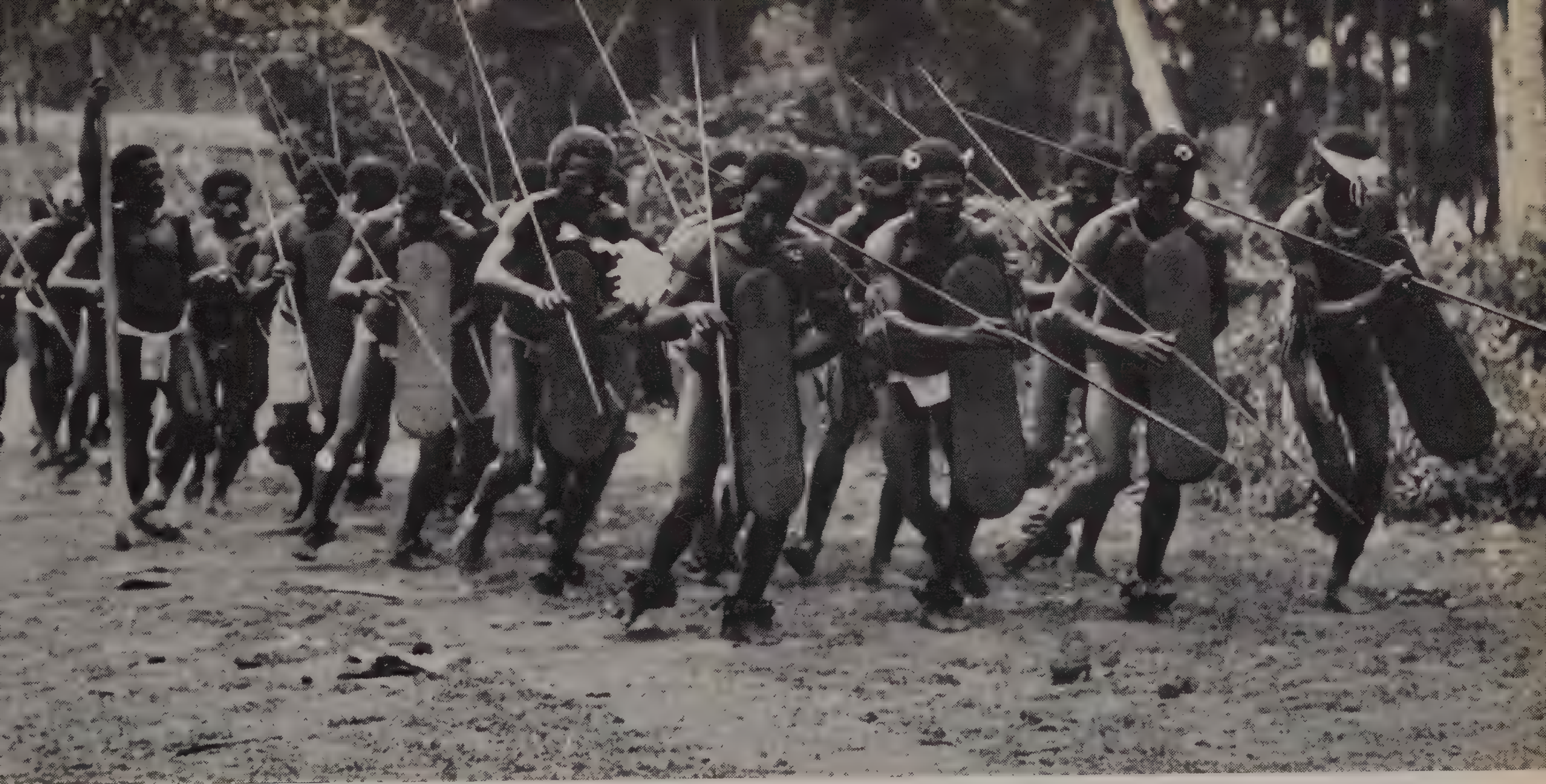
Dances are performed by men alone. The orchestra is provided with pan-pipes varying in length from four feet to a few inches, the longer ones, of course, providing the bass. The music of pan-pipes may be barbarous, but I have yet to meet the person who remains unmoved by it. I personally find it most exhilarating, as do the natives. I shall not easily forget an occasion on which, on account of having to return to my camp, I had to leave a dance early. As I crossed the line of hills on the far side of the valley in which the dance was taking place the sound of the pipes came through the trees, mellowed and blended by distance. It is no wonder that it pleases the spirits.

For a dance the men array themselves in all their finery, the young unmarried ones especially. Snow-white cowry shells are tied to the hair above the forehead, and elaborate arm-pieces, made from small bits of different coloured shells, are slipped on above the elbows. Necklaces of teeth —dog or porpoise, or occasionally human— hang around the neck, and plates of white shell are fixed to the temples. These plates are faced with sheets of elaborately fretted turtleshell. Fragrant herbs may be fastened in the belt and armbands. A spear or a bundle of bespelled herbs is held in one hand, and a dancing-stick, carved and painted to resemble a bird, in the other. Around the ankles are rattles made from dried bean-pods.

The dancers assemble first behind a bank of bushes while the orchestra tunes up. Then, when they are ready, a priest with slow and stately tread, gyrating as he comes, leads them forth. First come half the dancers, in two lines, then the orchestra, usually twenty in number, and, behind, the remainder of the dancers.



In the worship of the spirits of the dead, dancing plays a part. The music is provided by pan-pipes of varying length



Dances, whether religious or secular, are performed by men only. With spear and shield, streamers hanging from their armlets, dancers in Guadalcanal perform in honour of some leading man

They form up on the dancing area in two lines, the orchestra facing inwards towards each other, while the dancers all face one way. Women spectators stand on one side, men on the other. The dancers always face the women, turning their backs on their own sex.

The first movement of the dance consists simply in rhythmic stampings and arm movements—a savage dances with his whole body, not with his feet alone. But this is merely a preliminary warming up, both literally and metaphorically. The performers soon retire, and are again led on. This time the orchestra slowly parades around the area in column, blowing all the time, while the dancers in two sections begin a kind of follow-my-leader round and round, gesticulating wildly, leaping and gyrating, though they all keep strictly to the rhythm provided by the pipes and clanking anklets. The effect is not a bit monotonous, but wildly beautiful. Again they retire and advance, and the last movement begins, still quick and exciting, but without violent movements. People who have grievances against someone now prance around the assembly waving spears and uttering threats of vengeance unless they have redress for their wrongs. No one pays much attention to them, for it is recognized that one becomes carried away and beside oneself on these occasions.

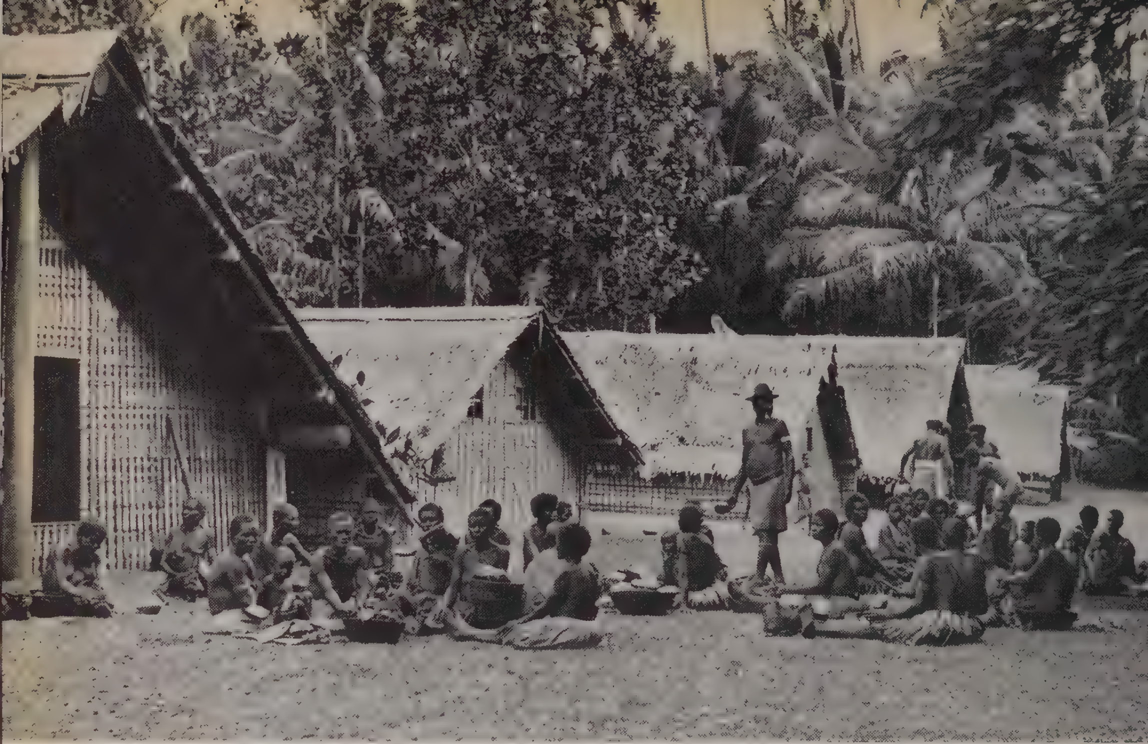
The dance of the salt-water people of Guadalcanal is an entirely secular affair, held in honour of some leading man, who pays the performers. It is less spectacular, though it too is interesting to watch. Each dancer carries a spear and shield and on his head or around his neck wears a circlet of dog's teeth. The hair is often decorated with white cockatoo feathers, and streamers hang from armlets and waist-belt. Here song alone provides the music. The performers line up in a column four deep, one behind the other, the singers in the middle. Again rhythm is the outstanding characteristic of the dance, though here imitations of the movements of birds and animals are given.

LEADERSHIP

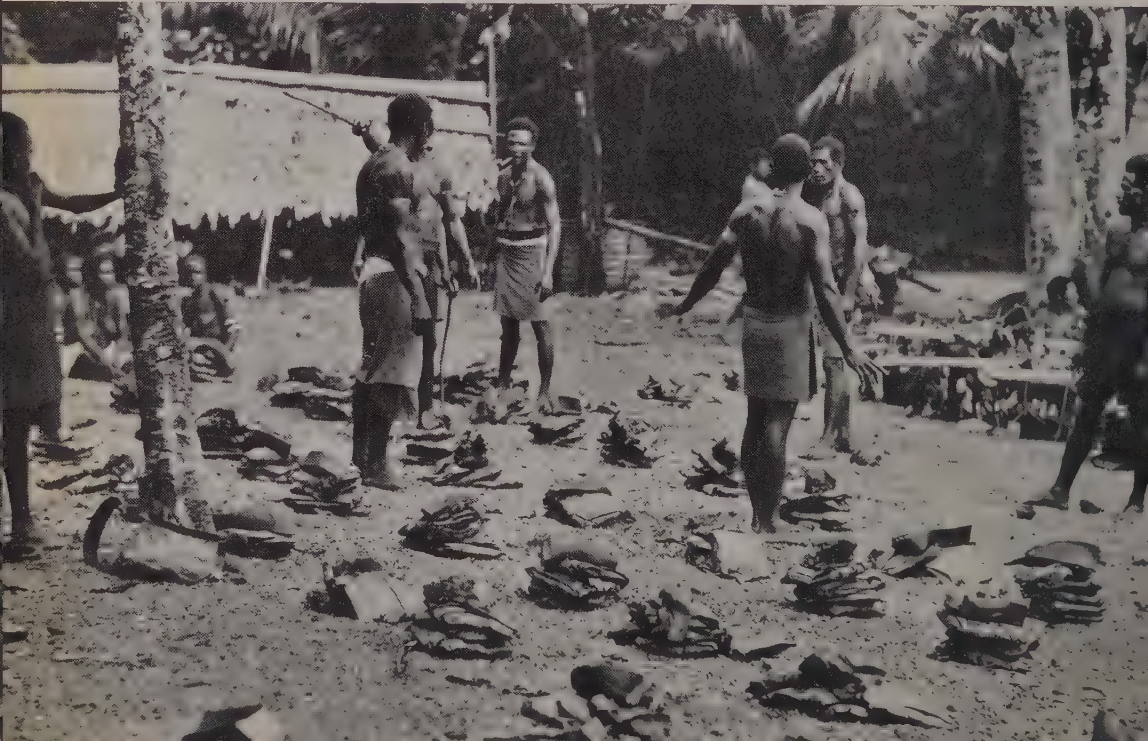
Chiefs are very seldom met with in the western Pacific, and even where they are found they never enjoy anything like the power of an African chief. Yet the various communities all have their leaders. A man achieves the position of leader by distributing wealth according to certain fixed social rules. Opportunities for distribution are provided by the feasts held at house-building, marriage, death and on other occasions. It may sound extraordinary that social distinction is achieved by giving wealth away and not by accumulating it for one's own use, but we must remember that in primitive conditions everyone is able to come by all the comforts ordinarily available. Rich and poor live in the same type of house, and there is no possibility of a man with a superabundance of shell money investing in, say, an automobile. Consequently he gives away his goods with lavish hand, thereby acquiring fame, prestige and general respect. An ambitious man, therefore, sets himself to accumulate shell money and garden produce, and to stock his sties with pigs.

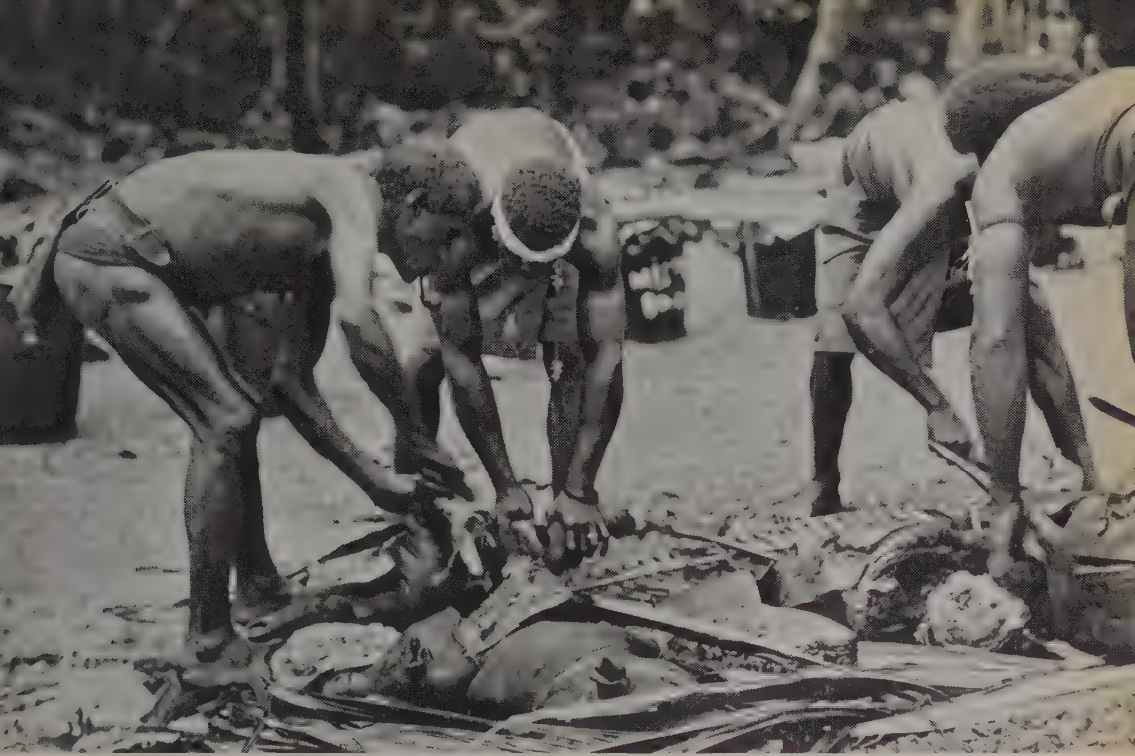
FEASTS

In Guadalcanal I attended a feast held at a house-building. The food provided included thirteen pigs, nineteen huge bowls of pudding made from mashed yam and coconut oil, each bowl being carefully garnished with sprays of areca nut, one hundred and twenty tins of meat, and an absolutely endless number of parcels of food resembling pancakes. The people of the village were first counted in a most ingenious manner. Men went around with coconut shells, and into these each person dropped a small stone. The food was then laid out on the ground in heaps, one for each stone. Two hundred and fifty-seven separate presentations were made. In every case the master of the



Leading men establish their prestige by distributing wealth, in the form of provisions for feasts on such occasions as funerals, marriages or house-building. To count the guests, each drops a stone into a coconut shell which is carried around (above) *and the food—pork and pudding wrapped in leaves—is then placed on the ground, one heap for each stone* (below)





The carving of the pigs (above), *which form the main item at a feast, is a task requiring considerable skill, as the cut and the size of the pieces are rigorously prescribed by custom. The blood is sometimes drained off into bamboos and boiled. Cooking is done by roasting in embers* (below) *though the method of baking on hot stones is also employed*

feast called out the name of the person, and his helpers carried the food to where he was sitting. Carving the pigs was a task requiring some skill, for the size of the pieces is rigorously prescribed by custom. In Malaita, where similar feasts are held, the blood is drained off into bamboos and boiled. This is the special perquisite of the helpers. Another Malaita speciality is pudding made from mashed taro and baked almonds. The taro are roasted in the ashes of a special fire twenty or thirty feet long by two wide. They are then carefully scraped by women, placed in wooden bowls and pounded by men with heavy sticks. Roasted almonds are thrown in, and the resulting mixture is a smooth oily paste with a slightly burnt flavour, not at all unpleasant, though highly indigestible; that is, to a European unused to such fare.

Givers of feasts can naturally depend on receiving the help of their fellow villagers in all their undertakings. When a wealthy man wishes to build a new house, therefore, everyone turns out to help him, and the work is quickly finished. So, too, when he wishes to make new gardens. This help enables him to give more feasts, for with fifty or sixty people to assist he has no hesitation in breaking the ground for a very large garden.

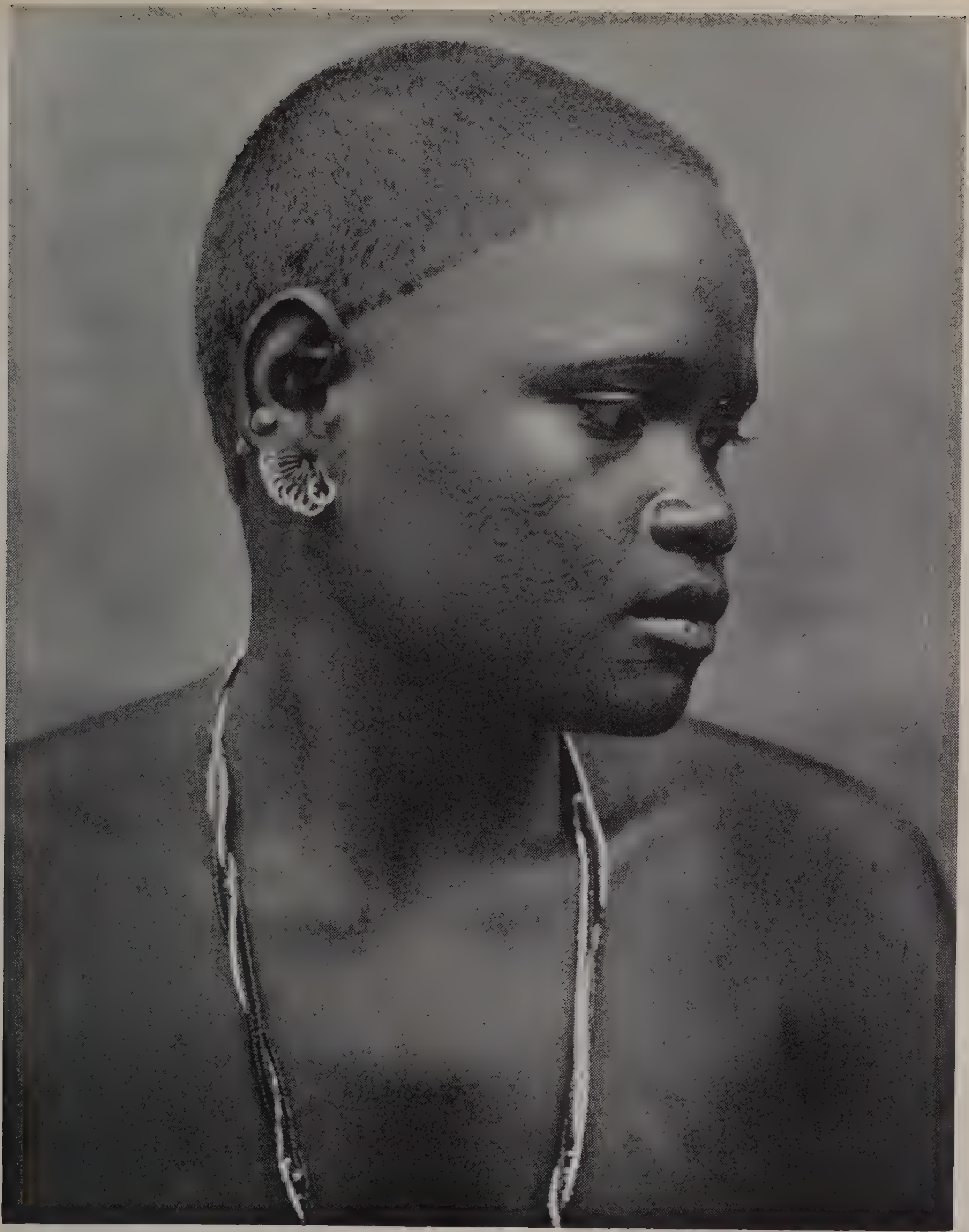
LAW AND ORDER

Every leader has his following of relatives and other individuals. He was formerly able to keep order amongst them by threats of refusal to allow his wealth to be used on their behalf. If this failed he could insult them so grievously that residence within the village was no longer possible if the offender wished to retain his self-respect. Offences by a follower of one leader against a follower of another were sometimes dealt with by an informal council composed of a number of leaders, but more usually the injured person and his group sought to retaliate on the wrongdoer. This often resulted in a village brawl, though at times the injured party was satisfied with the payment of compensation. People were very seldom killed in brawls of this kind. Another means of redress was by sorcery.

Today, unfortunately, the old leaders have to a certain extent suffered an eclipse. To begin with, only middle-aged men could acquire sufficient prestige to establish themselves in the community, and such men seem to have fallen an easy prey to introduced diseases. Then a man who wished to be wealthy found it convenient to have two or more wives to help him in his gardens. While the Administration of the Solomon Islands Protectorate permits polygamy, missions, of course, forbid the practice. Feasts are also apt to be frowned on by the same authorities. Indeed, the event which the feast used to celebrate now in some cases does not take place. Thus, with the prohibition of warfare, no celebration is possible after the accomplishment of vengeance. Again, in Guadalcanal missions forbid face-marking, which was also celebrated with a feast. Young girls used formerly (at times they still do) to have designs cut on their faces with a sharpened fishbone. The scars were regarded as highly ornamental. Another reason for the decline in importance of the native leaders is that they hesitate to correct the younger generation because it is far more at home than they are in the rapidly changing cultural environment.

GOVERNMENT METHODS

With the passing of the institution of native leadership it is moderately certain that unless some higher body had stepped in to exert control the islands would now be in a state of anarchy. Law and order are now maintained by the Administration. Each island has a district officer and is also divided up into small areas, each under a government-appointed headman. These men are allowed to settle small disputes according to former custom, while



'Young girls used formerly to have designs cut on their faces with a sharpened fishbone.' This practice, being connected with one of the feasts disapproved by the missions, has declined

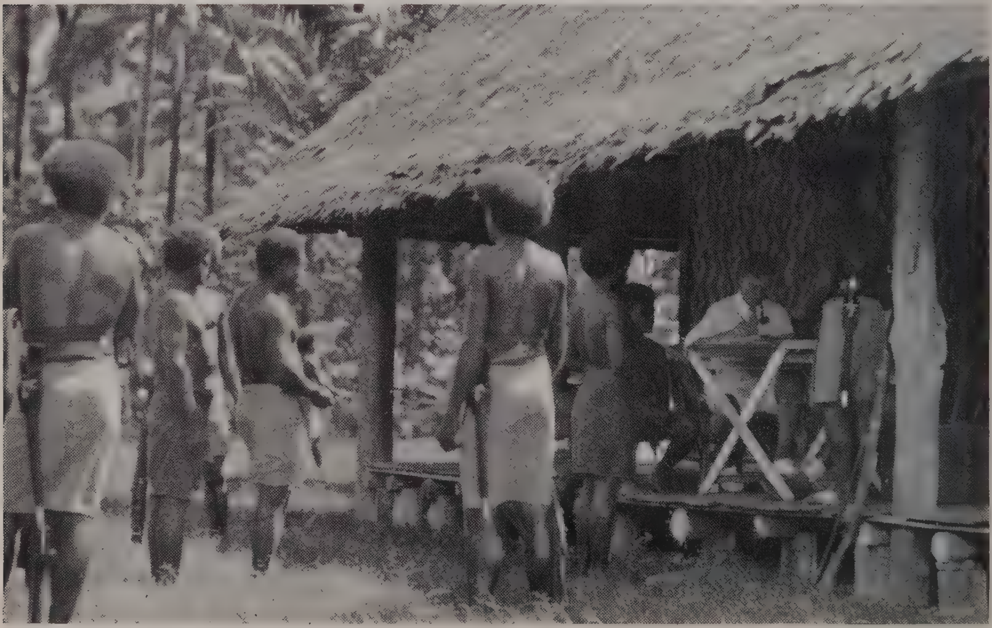
serious matters are brought before the district officer. While this headman system works moderately well, it is to be hoped that as the natives become more familiar with European justice they will be given a say in their government. Up to the present, however, this has for obvious reasons been impossible.

The usual method of punishment is by imprisonment. It is admitted that nothing else can be substituted, but there is no doubt that for natives it is not altogether suitable. They do not like prison, for it means work without pay, but a sentence carries no stigma of disgrace. They speak of prison colloquially as a place where one eats government rice. Prisoners have their heads shaved and are made to wear caps of white calico. They spend their time in public work, generally road-making or weeding in the government gardens.

Mention must be made of the Solomon Islands Armed Constabulary, who have in no small measure helped to bring the area under control. They are a fine body of men, looking particularly smart in uniforms of khaki loin-cloths with brightly coloured sashes.

MISSIONS

Missionary enterprise has gone hand in hand with the Government, and now most of the natives near the coast are Christians. Whether or not the whole population will be converted is not yet certain, but it is probable. To a certain extent this has meant the suppression of old ceremonies which gave the natives a zest for life. It is, in fact, rather to be regretted that some of them were not secularised and encouraged. There is, for example, no reason why the old dance should not be taught in the schools, for it is a fine physical exercise and far more suitable than Swedish drill, taught at present. Christmas and Easter provide opportunities for games,



Paying poll tax (five shillings) to the district officer at a court-house in the bush. Native police of the Solomon Islands Armed Constabulary keep guard while the taxpayers file up

'Missionary enterprise has gone hand in hand with the Government, and now most of the native near the coast are Christians.' (Above) *A cricket match near one of the Malaita mission stations* (Below) *A procession into church on All Saints' Day in Malaita*

The principal export of the Solomon Islands is copra—dried coconut kernels. Nearly all the young men work for a time on the plantations, and at loading the copra aboard ship

but these are a poor substitute for the elaborate festivals of heathen days. One of the features of the Easter celebration in Guadalcanal is a mock funeral. At this time, too, the men don hideous masks and go around the villages frightening the women. Native arts might also be encouraged by missions, and the churches then supplied with good native carved furniture instead of bad imitations of European objects.

The third civilizing agent in the Solomons is plantation work. Practically every youth at about the age of eighteen signs on and works for at least two years, and often much longer. Tasks include cutting and drying copra and loading it into overseas steamers. Natives also make excellent servants and cooks, and every white man has his 'house boys'.

It will be interesting to see what happens to the Solomon Islands during the next ten years. Will the natives become, as regards culture, pale shadows of ourselves? Or will they retain their distinct Melanesian characteristics? In a world that is becoming more and more standardized, it is perhaps to be hoped that they will resist change as strongly as possible.

PHOTOGRAPHIC NOTES

Edited by F. S. Smythe

6. FILMS (2)

The surface of an unexposed and undeveloped celluloid roll film is covered with a yellowish substance known as a light-sensitive emulsion. This, as was explained in these Notes last month, is manufactured by distributing finely divided grains of silver bromide throughout a solution of gelatine and water.

In what way does the image of the outside world, cast by the lens of a camera onto the light-sensitive surface of the film, become a negative picture?

A 'negative', from which positive pictures can be made by printing onto sensitized paper

Every square inch of the silver bromide emulsion covering the film contains millions of crystals of silver bromide. When these crystals are exposed to light their chemical properties are changed. This change in chemical properties is accompanied by no corresponding change in physical appearance; so that if you make an exposure on a film and then look at it in a darkroom it is impossible to observe any difference in the yellowish emulsion.

The change which has occurred, however, has to do with the power of the chemical bond holding the bromine to the silver in the salt silver bromide. The more the silver bromide is exposed to light the more this bond is weakened. In this way a latent and invisible record of the photographic image is made within the coating of emulsion on the film. The picture at this stage, which is the period when you have taken a photograph but not yet had the film developed, has really been translated into the relative strengths and weaknesses of the chemical bonds holding the bromine to the silver in the silver bromide throughout the emulsion.

In order to produce a picture from this purely chemical record, photographers use what is known as a "developer", so called because it is responsible for the development of a picture from the unseen record. This developer separates the bromine from the silver in the case of those grains which have been exposed to light. Where the negative has been exposed to the most intense light, a larger number of the grains are in a state to be influenced by the developer than in those parts of the negative where there has been less light.

Thus, after development a picture appears in which the deposits of dark, almost coke-like grains of silver are heaviest where the image has been brightest. Bright objects in the original scene are represented by a dense deposit of silver grains; while half-tones occur as a silver deposit of less density with fewer grains of silver, and the dark shadows as still less dense deposits of silver, because there are even fewer grains present.

The tone values of the original scene have in fact been *reversed*, and the result is the "negative" picture which can be seen under the red light of a darkroom.

Actually after development, since a large proportion of the picture still contains light-sensitive silver bromide, it is necessary to "fix" the negative so that the silver bromide is removed, leaving only the insensitive silver grains forming the negative picture which can now be looked at outside the darkroom.

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